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MERCURY CAPSULE NO. 16 CONFIGURATION SPECIFICATION (MERCURY – ATLAS NO. 8) (Title Unclassified)

SP-4

REPORT 6603-16 COPY NO. 44

A60538

MCDONNELL AIRCRAFT corp.
St. Louis, Mo.

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SUBMITTED UNDER National Aeronautics and Space Administration
(NASA Contract NAS 5-59)

PREPARED BY F. E. Jones Jan. 18, 1962 APPROVED BY F. J. Smith
F. E. Jones F. J. Smith

APPROVED BY L. M. Parker APPROVED BY
L. M. Parker

[redacted]

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1.0 SCOPE AND CLASSIFICATION

1.1 SCOPE - This configuration specification shall define the details of design, construction, and equipment requirements for a Manned Instrumented Satellite Capsule (M.A.C. No. 16/MA-8) as follows:

NASA Designation	Project Mercury
Designer's Name	McDonnell Aircraft Corporation (M.A.C.)
Model Designation	Model 133K
Number and Places for Crew	One Cabin Enclosure
Launch Vehicle	Atlas D Missile

1.1.1 MISSION - The flight objectives of the Mercury Model 133K Capsule and Atlas combination (M.A.C. No. 16/MA-8) shall be launching of this capsule into a manned semipermanent orbit and subsequent safe return to the surface of the earth at a designated time and/or position through use of retrograde thrust and aerodynamic drag. Orbital insertion shall occur at approximately 528,496 international feet altitude (approximately 87 nautical miles) at an inertial velocity of 25,719 feet per second. The elliptical orbit shall have a perigee altitude of not less than 87 nautical miles and an apogee altitude of not greater than 135 nautical miles. The nominal position of the point at which re-entry is initiated shall be such that impact occurs in a prescribed area in the Atlantic Ocean. However, in the event of an emergency, it shall be possible for the astronaut to initiate re-entry at any point during an orbital cycle. The re-entry shall be accomplished by application of retrograde thrust to produce a perigee altitude within the atmosphere. The magnitude and direction of retrograde thrust shall be applied so that angles of re-entry into the atmosphere at an altitude of 400,000 feet (approximately 66 nautical miles) will be between 0.734 and 2.31 degrees. The atmospheric forces used in trajectory or other calculations shall be based on the atmospheric density and temperature variations presented in Paragraph 3.2.7 and Figure 2, herein.

1.1.1.1 OBJECTIVES - The test objectives of this mission shall be as follows:

a. Evaluate the effects on an astronaut in prolonged weightlessness.

1.1.1.1 OBJECTIVES - (Continued)

b. Evaluate the effects on an astronaut in the Mercury Model 133K Capsule environment for the extended flight time and demonstrate that the capsule environment is satisfactory during the prelaunch, inflight, and post-landing phases of the mission.

c. Evaluate the performance of the Mercury Model 133K Capsule systems for the duration of the entire flight.

Test program objectives involving this capsule shall be the acquirement of data leading up to the primary concern of this research; that of man's ability to adapt to and perform in a space environment and those environments associated with projection into space and subsequent safe return to the earth's surface. The launching site for MA-8 shall be Port Canaveral, Florida.

2.0 APPLICABLE SPECIFICATIONS AND OTHER PUBLICATIONS - McDonnell Aircraft Corporation's prime objective relative to government specifications shall be compliance with applicable documents to the most practicable extent, with the object of providing an optimum operational vehicle within the specified time schedule.

2.1 REFERENCES - The following documents are referenced herein.

M.A.C. Report No. 6495, "Project Mercury Specification Applicability Criteria," dated 4 December 1958, Revised 1 July 1959.

M.A.C. Report No. 8140, "Contractor Furnished Equipment Status Report," dated 27 March 1961, Revised 5 September 1961.

NASA Specification No. S-6, "Specification for Manned Space Capsule," Revised 26 January 1959.

2.1.1 PRECEDENCE - In event of a discrepancy between this document and any document referenced herein, this specification shall take precedence.

2.2 PROCESS SPECIFICATIONS - The following M.A.C. Process Specifications shall apply specifically to the Project Mercury Capsule herein:

P.S. No.	TITLE
11051	Cementing of Heat Blankets for Model 133
11224	Sealing of Model 133 Capsule
12301	Cleaning of Model 133 Environmental Control System Lines and Nonoperating Components
12420	Chromic Acid Treatment of Aluminum Tanks for Model 133
13214	Black Oxide Finish for High Emissivity for Model 133
13334	Preparation and Application of Coatings to Interior Surfaces of Sealed Cabin Area of Model 133
13430	Exterior Paint Finishing of Model 133 Capsules
14039	Fabrication of Model 133 Tower Insulation
14043	Fabrication of Model 133 Astronaut Seat Assembly

2.2 PROCESS SPECIFICATIONS - (Continued)

P.S. No.	TITLE
16001.5	Marking of Model 133 Parts and Assemblies
17046	Care, Handling, Storage and Assembly of Model 133 Glass
17305	Sealing of Printed Wiring for Model 133 Flight Test Instrumentation
17400	Installation of Electrical Wiring in Model 133
17410	Fabrication of Electrical Wire Assemblies for Model 133
17410.1	Assembly of Electrical Cable Terminals and Splices for Model 133
17410.2	Assembly of Electrical Connectors for Model 133
17410.3	Assembly of Radio Frequency Cables for Model 133
20106	Storage and Handling of Silver-Zinc Batteries for Model 133
20113	Care, Handling and Storage of Model 133 Pyrotechnics
20115	Handling, Storage, and Installation of Model 133 Impact Skirt
20151	Storage and Handling of Hydrogen Peroxide (H_2O_2)
20204	Repair for Skin Puncture of Model 133 Capsule Wall
20500	Fabrication and Housekeeping Policies Applicable to Model 133
20501	Requirements for Special Assembly Areas for Model 133
20505	Storage and Handling of Model 133 Environmental Control System
20506	Storage and Handling of Model 133 Reaction Control System
21030	Leak Testing of Model 133 Structural Assemblies
21311	Incoming Inspection of Model 133 Space Capsule Coatings
22810	Soft Soldering of Electrical Connections for Model 133
23502	Acceptance Procedure for Model 133 Forward Viewing Window Assembly

2.3 CONTRACT CHANGE PROPOSALS - The following Contract Change Proposals (CCP's) have been incorporated and shall be considered basic to this configuration specification as approved through negotiation with NASA:

CCP	TITLE
3	Posigrade Rocket Installation
6	Manual Emergency Controls for Capsule Separation/Escape Rocket Firing, Escape Tower Jettison, Antenna Jettison, and Emergency Parachute Deployment.
41	Installation of Reefed Ring-Sail Landing Parachutes
42	Deletion of Orbit Light
43	Instrumentation Changes; Subcarrier Oscillator and Commutator Replacements
44	Deletion of Requirement for Impact Pressure Measurement
45	Addition of 2 Watt Orbital UHF Transmitter
46-2 Rev. "A"	Provide Supplemental Instrumentation, Telemetry, and Communications Equipment
48	Power Output Increase of Low Power Telemetry
58-1	Astronaut Emergency Egress Hatch Installation
61-2	Redundant Rate Stabilization Control System
66	Frequency Changes for Communications Systems
73	Astronaut Observation Window Installation
74	Rescue Aids Switch By-pass Relay and By-pass Switch for 30-Second Retro Firing Delay
76	Main Instrument Panel Redesign
78	Mercury/Atlas Adapter Redesign
82	Capsule Dye Marker Change
84	Telemetering of Posigrade Rocket Firing

2.3 CONTRACT CHANGE PROPOSALS - (Continued)

CCP	TITLE
85	Radar Chaff Redesign and Reinstallation
90-1	Production Installation of Landing Impact Skirt
91	Elimination of Minitrack/Microlock Beacon
93	SOFAR Bomb Installation
98	Removal of Smoke Recovery Aid
101	Post-Landing Operational Sequence Change for Capsule Instrumentation
106	Provision of Patch Cable - Command Receiver Code Assembly
109	Addition of Astronaut-Operated Switch for Time Zero Relay
113	Escape Tower Modification
117	Provision of Retrograde Rocket Firing Information
130	Provision of "Super Sarah" UHF Rescue Beacon
131	Satellite Clock Change
160	Transducer Replacement
164	Double-Pulse Coding For "S" Band Beacon
165	Installation of Whip Antenna
184	Modifications to Mercury Bio-Sensors for Man
189	Manual Hand Controller System, Improvement Changes thereto.
213	Incorporation of a Constant Bleed Flow and O_2 Partial Pressure Transducer in ECS.
217	Capsule Dye Marker Change
218	Patch Cables for all Command Tone Combinations

2.3 CONTRACT CHANGE PROPOSALS - (Continued)

CCP	TITLE
226	Incorporation of a 5 PSI Differential Cabin Pressure Control Valve
228	Double-Pulse Coding for "C" Band Beacon
239	Triple Nozzle Installation on Jettison Rockets
243	Voltage Regulation For Telemetered Events
251	Improvement of Battery Installation/Removal Time
261	Telemetering of Periscope Door Closure
274	Modify EKG Amplifiers
280	C-Band Beacon Wobulator
287	Disabling the Voice Operated Relay (VOX)
289	Provision of Lockout Feature, C-Band Beacon Modification
300	Astronaut Blood Pressure Device
304	S-Band Radar Beacon Frequency Change
309	ECS Spring-Loaded Inlet Check Valve
313	Additional Instrumentation for Capsules 10 and 16 thru 20
317	Conversion of Capsule 16 to Manned Orbital Mission
322	Provision of Lockout Feature, S-Band Beacon Modification
329	Snorkel Inflow Valve By-pass Switch and Blow-off Door Interlock
336	Oxygen Bottle Nomenclature Change
342	Commutator Replacement
344	Cable Retention System Improvements

2.4 REQUEST FOR ALTERATION - The following requests for alteration (RFA) recommended during the respective Development Engineering Inspections (DEI) have been incorporated on Capsule 16.

2.4.1 DEVELOPMENT ENGINEERING INSPECTION OF MERCURY CAPSULE NO. 7 - 16 AUGUST THROUGH 18 AUGUST 1960.

RFA NO.	TITLE
1	Manual Hand Controller
2	Pull Ring Alignment
4	Gage Limits
6	Swizzle Stick
7	Water Bottles
8	Wire Bundle Interference with Egress
9	Inspection Items
11	Rescue Aids Switch
12	Map Case and Associated Equipment
13	Temperature Control Markings
17	Right Hand Panel Release Pin
20	Tower UHF Antenna Incompatibility
21	Grommet - Adapter
26	Moisture Surrounding Retro Package
29	Landing Impact Bag
30	Capsule Booster Umbilical Door
31	Structures - Tower Separation
32	Heat Shield Release Mechanism
33	Abort Command Wires

2.4.1 DEVELOPMENT ENGINEERING INSPECTION OF MERCURY CAPSULE NO. 7 - 16 AUGUST THROUGH 18 AUGUST 1960. - (Continued)

RFA NO.	TITLE
36	Auxiliary Umbilical Mechanical Disconnect Wiring Harness
38	Retro Bolt Upper Wiring Harness
41	Battery Installation
42	Electrical Relay Box-Cockpit Installation
44	Cabin Pressure Control
46	ECS Suit Circuit Pressure Test Valve
47	ECS Water Separator
48	ECS Coolant Water Tank
49	Cable Guide Clip
51	Environmental Oxygen Indicators
54	RAYTHERM Insulation Caps on Spare Wires
60	Transducer Power Supply
61	3-Volt Reference Telemetry
62	Track Assignments, Tape Recorder
63	Instrument Programmer Noise
64	Camera Lens Locks
68	DC Amplifier-Telemetry
69	Tape Recorder Dust Cover
70	Instrumentation - Mixer Card
71	Oxygen Compatibility
72	Umbilical Plug Door

2.4.1 DEVELOPMENT ENGINEERING INSPECTION OF MERCURY CAPSULE NO. 7 - 16 AUGUST THROUGH 18 AUGUST 1960. - (Continued)

RFA NO.	TITLE
76	Parachute Container
79	Sharp Edges in Parachute Compartment
80	Antenna Can Shield Ceramic Coating
81	Antenna Gun Ejector Housing
82	Safety Wire and Shield Protection
84	Helium Line to Antenna Balloon
87	Capsule Installations
91	Marker Dye - Fluorescein
96	RCS Roll Nozzle Alignment
98	Reaction Control System Sealing
99	Capsule Installation (Periscope)
101	Survival Kit Cover Zipper
102	Small Pressure Bulkhead Snap Ring

2.4.2 DEVELOPMENT ENGINEERING INSPECTION OF MERCURY CAPSULE NO. 9 AND 11 - 16 AND 17 JANUARY 1961.

RFA NO.	TITLE
2-1	Amp-Cal-34° Attitude
2-2	Amp-Cal-"B" Bus Supply Voltage
2-4	Thermal Barrier - RCS Thrusters
2-7	Switch Position Identification
2-8	Re-Orient Pilot Chute Deploy Gun
2-9	Parachute Canister Engagement

2.4.2 DEVELOPMENT ENGINEERING INSPECTION OF MERCURY CAPSULE NO. 9 AND 11 - 16 AND 17 JANUARY 1961. - (Continued)

RFA NO.	TITLE
2-11	Explosive Bolt Wire Bundle
2-12	Emergency O_2 Rate Valve Reset Handle
2-17	"B" Nuts on Fittings - H_2O_2 Throttle Valve
2-19	Remove Corners - H_2O_2 Manual Roll Valve Guard
2-21	Trim Tension and Compression Straps at Small Pressure Bulkhead
2-23	Prevent Interchangeability of Electrical Connectors by Mechanical Means
2-24	Timing System Tests - Initiation of Retro-Fire
2-25	ASCS Roll Solenoid Wire Bundle Arrangement
2-26	Connect Main and Secondary Busses Together
2-29	Redesign SOFAR Bomb Mounting Bracket Straps
2-30	Solid Type Ground Handling Cover for Tower Disconnect Plug
2-31	Testing of Barostat Outside Altitude Chamber
2-32	Investigate Time Delays of Various Electrical Relays
2-34	Emergency O_2 Rate Valve
2-35	Disassemble and Clean all Cameras
2-36	Modify EKG Amplifier
2-41	Corrosion of H_2O_2 Lines
2-43	Remove Zinc Coating on all Components
2-45	Review Installation Procedures for all Capsule Equipment
2-50	Protect Line Filter from Damage

2.4.2 DEVELOPMENT ENGINEERING INSPECTION OF MERCURY CAPSULE NO. 9 AND 11 - 16 AND 17 JANUARY 1961. - (Continued)

RFA NO.	TITLE
2-51	PIA of Capsule Equipment Prior to Installation
2-53	Remove Epon Holding Blankets Under Thrusters
2-54	Trial Fit All Capsule Modifications
2-56	Potting of Capsule Wiring
2-57	Thermocouple Installation on Shingles
2-60	Thermistor in O_2 Supply Line
2-61	Telemetry Transmitters
2-62	Tower Jettison Rocket Sequencing
2-64	Tower Clamp Ring Restraint Cables
2-65	Thermal Protection Near Thrusters
2-66	Access to H_2O_2 Fill Connector
2-72	Modify Shields on Pilot's Window
2-73	Change Roll Rate and Attitude Needle Color to be Compatible with Red Light
2-74	Shoulder Harness Friction
2-75	Safety Clips Over "RECOMP" and "DECOMP" Handles
2-76	Repaint Control System Recompress and Decompress Handles
2-77	Identification of Helium Pressure Regulator Resistor Orifice
2-79	Manual Control System Linkage
2-80	Marman Band Separation Switches
2-81	Align Pitch Attitude Dial 34°
2-82	Forces Required on All Sequencing Cabin Pressure and RCS Handles

2.4.3 DEVELOPMENT ENGINEERING INSPECTION OF MERCURY CAPSULES NO. 12 AND 15 - 6 AND 7 MARCH 1961.

RFA NO.	TITLE
3-1	Drogue Deploy Separation Switch
3-2	"B" Nut and Check Valve
3-4	C and S Band Beacon Lockout
3-6	Pitch and Yaw Thruster Assembly - Bracket Clip
3-7	Antenna Can Shingles
3-10	Holes in "B" Package Cover
3-12	Mechanical Link on the Outflow Snorkel Valve
3-13	MDE Protective Cover, Antenna Can Electrical Disconnect
3-15	Main Chute Hold-Down Foot
3-16	SOFAR Bomb Mounting Clamps
3-17	Top Capsule Ring
3-18	Force Sensor Electrical Wire Bundles - Bracket
3-19	Plate Nuts - Antenna Can
3-20	Mounting Tabs on Large Bulkhead Shield
3-21	Fiberglas Shield in Trunnion Mount Area
3-22	Antenna Fairing Section Leg Cutout
3-23	Bushings in the Aerodynamic Wedges
3-25	Cutoff and Sensitivity Adjuster for Audio Center
3-26	H_2O_2 Fill and Drain Valve - Handle and Stem
3-27	Single "O"-Ring on Two-Way Selector Valve and/or Manual Shut-Off Valves

2.4.3 DEVELOPMENT ENGINEERING INSPECTION OF MERCURY CAPSULES NO. 12 AND 15 - 6 AND 7 MARCH 1961. - (Continued)

RFA NO.	TITLE
3-33	Programmer Relocation
3-37	Screens Upstream of Electrically Actuated RCS Valves
3-43	EKG Amplifiers - Modification
3-46	Watertight Capsule
3-49	Batori Computer

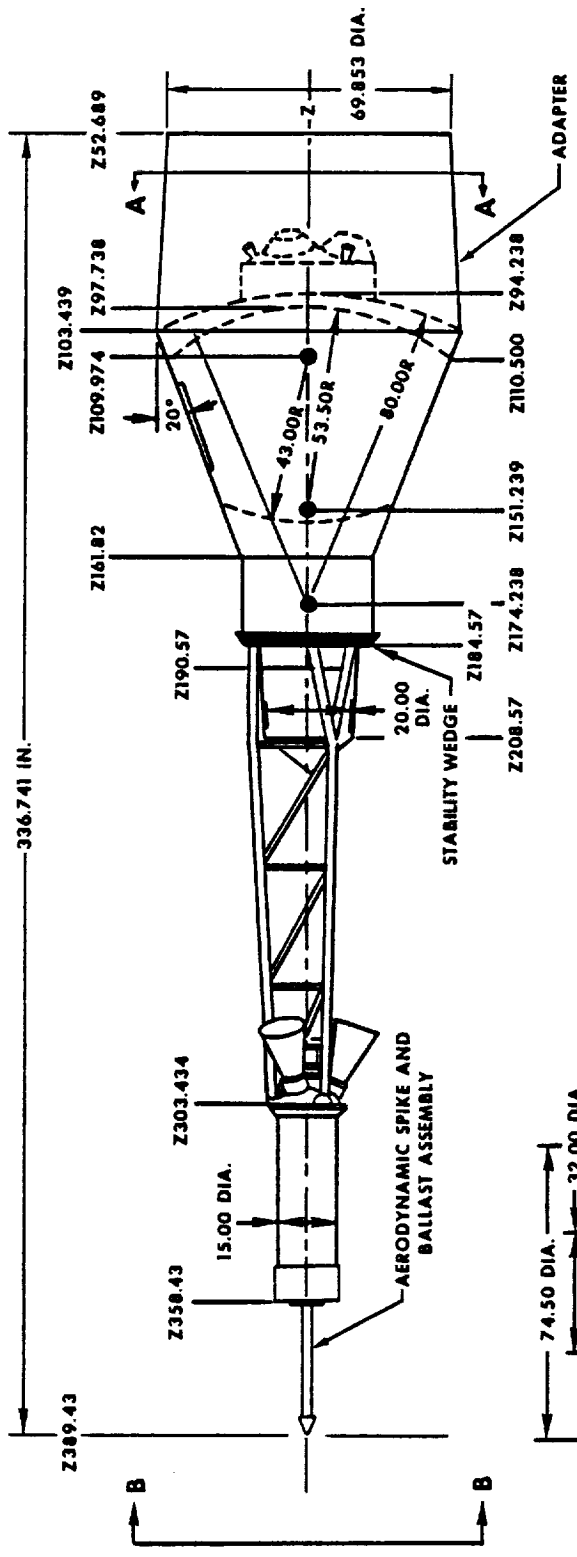
2.4.4 DEVELOPMENT ENGINEERING INSPECTION OF MERCURY CAPSULE NO. 18 - 23 AND 24 MAY 1961.

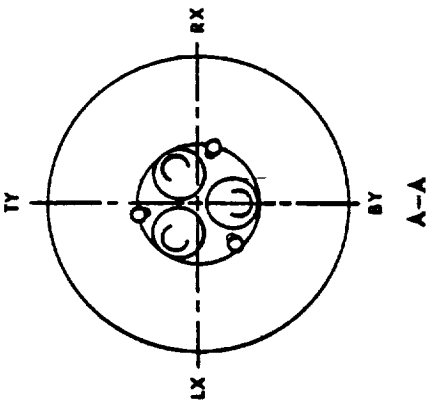
RFA NO.	TITLE
4-1	Serial Numbers to all Relay Assemblies
4-2	Electrical Connectors
4-5	Cable Interference with Heat Shield
4-8	Time Base for Astronaut Observer Camera
4-13	Exhaust Port of Cabin Pressure Relief Valve-Cover
4-14	Switches on Snorkel Inflow Valve
4-15	Intermediate Reference Voltages
4-17	Shingle-Limit Switch Interference
4-20	Redundant Amp/Cal Signal Ground
4-24	Quick Disconnect Fitting
4-25	Cable for Changing Radio Command Coding
4-26	Re-Wire the Whip Antenna Firing Circuit
4-27	Fuse Block Quick Release Fasteners
4-28	Signal Limiters on Output of E.K.G. Amplifiers

2.4.4 DEVELOPMENT ENGINEERING INSPECTION OF MERCURY CAPSULE NO. 18 - 23 AND 24 MAY 1961. - (Continued)

RFA NO.	TITLE
4-30	Maximum Altitude Sensor Power Supply
4-31	Heat Shield Linkage System
4-32	Hand Controller for Fly By Wire Operation
4-35	Shear Pins in the Manual Control Linkage
4-36	Scuppers for H_2O_2 Fill Connection
4-37	H_2O_2 Fill Valve - Passivation
4-38	"ON - OFF" Action of Fly-By-Wire Microswitches
4-39	Throttle Valves Installation Procedure
4-42	HF Rescue Antenna Actuation
4-44	Communications System Noise

GENERAL ARRANGEMENT
(MERCURY CAPSULE-ATLAS ADAPTER)





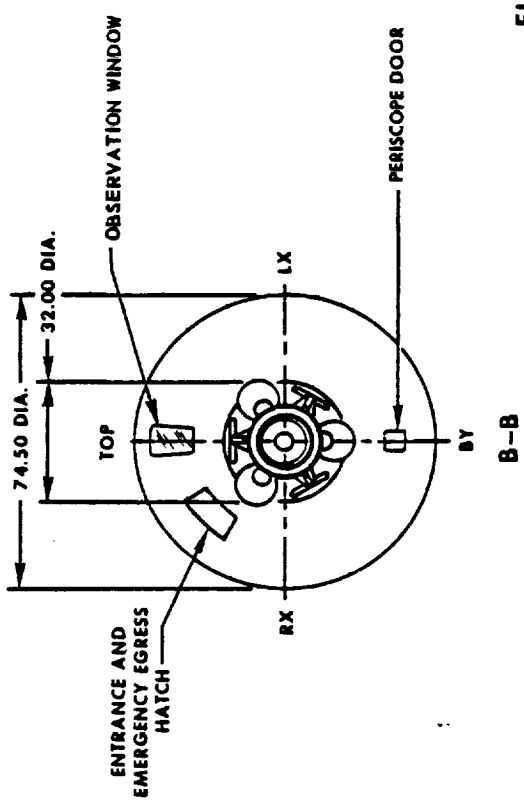


FIGURE 1

3.0 REQUIREMENTS

3.1 CHARACTERISTICS

3.1.1 WEIGHT AND BALANCE - Specification MIL-W-25140 and Technical Order 1-1B-40 shall be utilized as reference guides.

3.1.1.1 GROSS WEIGHT - Current weight breakdown and center of gravity (C.G.) of the capsule as described herein are included. The actual weight and balance data will be supplied when available.

3.1.1.2 LAUNCH WEIGHT - The launch weight of the Mercury Capsule No. 16 shall be defined as the basic capsule and equipment, pertinent to the mission to be performed, plus the adapter escape tower assembly, retrograde rocket assembly, hydrogen peroxide (H_2O_2), and posigrade fuel.

3.1.1.3 ORBIT WEIGHT - Orbit weight is defined as the weight of the capsule when projected into orbit.

3.1.1.4 RE-ENTRY WEIGHT - Re-entry weight is defined as the orbit weight, less H_2O_2 and water used during the orbit period, and during re-entry initiation, and less the retrograde rocket assembly.

3.1.1.5 ABORT WEIGHT - Abort weight is defined as the orbit weight of the capsule less the retrograde rocket assembly plus the escape system.

3.1.1.6 IMPACT WEIGHT - Impact weight is defined as the re-entry weight, less the drogue and main parachutes, antenna fairing assembly, and less any ablated material, H_2O_2 and water used and jettisoned during re-entry.

3.1.1.7 WEIGHT AND BALANCE SUMMARY

a. Vehicle Weight Breakdown

ITEM	WEIGHT
Structure	610.70
Adapter-Capsule to Booster	189.44
Escape System	1082.52
Heat Shield-Ablation	299.66

3.1.1.7 WEIGHT AND BALANCE SUMMARY - (Continued)

ITEM	WEIGHT
Stabilization Control System	283.78
Retrograde System	295.19
Landing System	315.71
Instruments and Navigation Equipment	113.90
Electrical Group	320.82
Communications	112.91
Environmental Control System	147.06
Telemetry and Recording	120.31
Recovery Gear	34.79
Crew and Survival Equipment	246.08
Ballast - Flotation	41.00
Manufacturing Variations	20.00
Gross Weight Launch Vehicle	4233.87

b. Normal Mission

ITEM	WEIGHT	C.G.* LOCATION
Gross Weight Launch Vehicle	4233.87	168.20
Less: Escape System (W_j)	-1082.52	
Add: $.2W_j$	216.50	
Effective Launch Weight	3367.85	
Less: $.2W_j$	-216.50	
Gross Weight - Tower Separated	3151.35	118.94
Less: Adapter - Capsule to Booster	-189.44	
Posigrade Fuel	-6.24	

* C.G. location is given as Z station. Theoretical edge of the heat shield is Z = 103.44 (A point on a 37.25 inch circular radius formed by the intersection of the heat shield 80.00 inch spherical radius and the projection of the capsule conical surface).

3.1.1.7 WEIGHT AND BALANCE SUMMARY - (Continued)

ITEM	WEIGHT	C.G.* LOCATION
Orbit Weight	2955.67	121.21
Less: H_2O_2 Orient and Orbit	-5.57	
Coolant Water	-9.80	
Retrograde Weight	2940.30	121.30
Less: Retrograde Fuel and Covers	-147.06	
H_2O_2 - Retrograde Hold	-5.85	
Retrograde Fired Weight	2787.39	123.06
Less: Retrograde Package	-113.88	
Re-entry Weight	2673.51	124.61
Less: Ablated Material	-6.50	
H_2O_2 Re-entry Hold	-9.73	
Coolant Water	-2.20	
End of Re-entry Weight	2655.08	124.76
Less: Antenna Assembly	-88.61	
Horizon Scanners		
Drogue Chute		
Chaff		
Main Chute Deployment Weight	2566.47	122.25
Less: Main Chute	-65.33	
SOFAR Bomb	-1.98	
H_2O_2 Jettison	-34.24	
Impact Weight	2464.91	121.15
Extend Whip Antenna	0.00	
Less: Reserve Chute	-63.79	
Pilot Chute	-3.57	
Dye Marker	-2.75	
Flotation Weight	2394.80	119.75

* C.G. location is given as Z Station. Theoretical edge of heat shield is Z = 103.44 (A point on a 37.25 inch circular radius formed by the intersection of the heat shield 80.00 inch spherical radius and the projection of the capsule conical surface).

3.1.1.7 WEIGHT AND BALANCE SUMMARY - (Continued)

c. Abort Condition

ITEM	WEIGHT	C.G.* LOCATION
Gross Weight Launch Vehicle	4233.87	168.20
Less: Adapter - Capsule to Booster	-189.44	
Retrograde/Posigrade Assembly	-267.19	
Abort Weight	3777.24	177.97
Less: Escape Rocket Propellant	-293.20	
Abort Weight - No Fuel	3484.04	165.45
Less: Escape Tower	-789.32	
Re-entry Weight - Abort Condition	2694.72	124.45
Less: H_2O_2 Orient	-3.83	
Antenna Assembly	-88.61	
Main Chute Deployment Weight - Abort	2602.28	122.00

* C.G. location is given as Z station. Theoretical edge of the heat shield is Z = 103.44 (A point on a 37.25 inch circular radius formed by the intersection of the heat shield 80.00 inch spherical radius and the projection of the capsule conical surface).

3.2 GENERAL DESCRIPTION

3.2.1 CONFIGURATION - The capsule configuration shall be of the type shown in Figure 1 and shall fulfill the requirements specified herein. The complete capsule shall be comprised of the following:

a. Structure (See Paragraph 3.4)

b. Heat and Micrometeorite Protection (See Paragraph 3.6)

c. Booster Adapter and Separation System (See Paragraph 3.7)

d. Crew Station (See Paragraph 3.8)

e. Consoles and Controls (See Paragraph 3.8.8)

f. Instrumentation and Display (See Paragraph 3.8.9)

g. Environmental Control System (See Paragraph 3.9)

h. Stabilization Control Subsystem (See Paragraph 3.10)

i. Reaction Control System (See Paragraph 3.10.3)

j. Retrograde Rocket System (See Paragraph 3.11)

k. Posigrade Rocket System (See Paragraph 3.11.4)

l. Escape System (See Paragraph 3.12)

m. Power Supplies (See Paragraph 3.13)

n. Communication Equipment (See Paragraph 3.14)

o. Recording Equipment (See Paragraph 3.15)

p. Navigational Aids (See Paragraph 3.16)

q. Landing, Post-Landing and Survival Systems (See Paragraph 3.17)

r. Handling Provisions (See Paragraph 3.18)

s. Pyrotechnics (See Paragraph 3.20)

3.2.2 SELECTION OF MATERIALS - Mission requirements of the capsule dictate use of high temperature resistant materials. Heat resisting materials such as titanium, beryllium, steel, nickel base alloy (Rene' 41), and insulation materials such as Thermoflex, fiberglas and ceramic coatings shall be used. Where practicable, materials in accordance with the requirements of ANA Bulletins 143d and 147r shall be utilized.

3.2.3 FABRICATION - Structural design concepts of the capsule emphasize employment of proven manufacturing techniques and methods to the greatest possible extent. Maximum use shall be made of developed "off-the-shelf" components fabricated by dependable subsystem manufacturers. McDonnell Aircraft Corporation standards of workmanship, processes and procedures are based on fabrication of production articles according to military standards.

3.2.4 INTERCHANGEABILITY AND REPLACEABILITY - The interchangeability and replaceability intent of Specification MIL-I-8500A (ASG) shall be met on those items of equipment possessing identical physical characteristics and functions in relation to capsule usage as defined in M.A.C. Report No. 6495, revised 1 July 1959. Interchangeability and replaceability requirements are not considered mandatory on basic capsule structure. Interchangeability and replaceability for those equipment items as set forth in this paragraph shall be assured by design requirements, nature of manufacture and monitoring by contractor personnel, and need not be physically demonstrated by the exchange or removal of equipment items from the capsule and replacement of these items in a formal demonstration.

3.2.5 FINISH - Finish requirements shall be as specified in the Finish Specification, Drawing No. 45-90000.

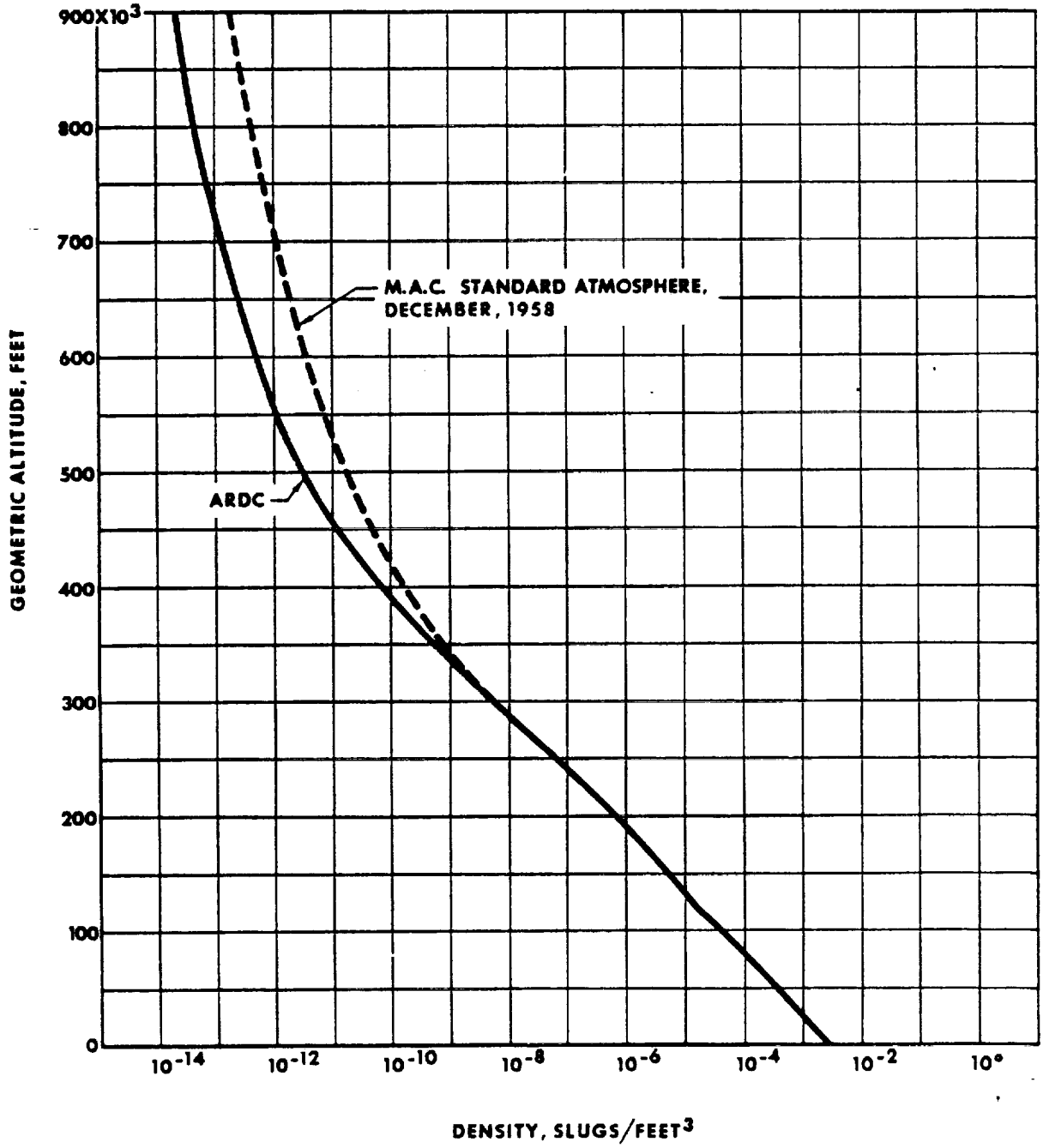
3.2.6 IDENTIFICATION AND MARKING - MIL-STD-130 shall be considered as a reference guide in identification of the capsule and capsule components. Marking shall be in accordance with Specification MIL-M-25047 as applicable. Drawing No. 45-00009 shall define external capsule color requirements and shall specify that the words "UNITED STATES" in six-inch block letters, shall be painted on opposite sides of the capsule. Capsule test cable plug or receptacle identification shall be in accordance with Drawing No. 45-00010. Capsule instrument range marking shall be in accordance with Drawing No. 45-00011.

3.2.7 EXTREME ENVIRONMENTAL REQUIREMENTS - Trajectory characteristics shall be based on the atmospheric density and temperature variations of ARDC 1959 model atmosphere. Earlier data, as presented in Figure 2, may be used when its use is not critical or when it is compatible with ARDC 1959 model atmosphere. The capsule, all subsystems, and components shall be designed to withstand the environmental conditions which are expected to be encountered during the mission outlined in Paragraph 1.1.1.

3.2.8 LUBRICATION - Lubrication of components where required shall be in accordance with the requirements of Specification MIL-L-6880B. Lubrication data shall be included in maintenance handbooks. No petroleum-base lubricants shall be used. Lubricants shall be of the silicone base, fluorolube, oxylube 702, and dry film type. Lubrication shall not cause any toxic or flammable substances to occur in the astronaut's compartment or in the environmental control system.

3.2.9 RELIABILITY - An integrated reliability program shall be conducted throughout the design, development and fabrication of the Mercury capsule. This shall include the salient features outlined in Specification MIL-W-9411 to the most practicable extent within the scope of the program. The design approach shall emphasize the safety of the mission. Although not specified herein in every instance due consideration shall be given to simplicity, redundancy, and the use of back-up systems in order to improve mission reliability.

ATMOSPHERIC PROPERTIES



(A) ATMOSPHERIC DENSITY VERSUS GEOMETRIC ALTITUDE

FIGURE 2

3.3 AERODYNAMIC AND HYDRODYNAMIC CONSIDERATIONS - The design configuration of the capsule described herein relative to aerodynamic and hydrodynamic considerations has been based on the following:

a. The over-all capsule configuration at the time of re-entry shall be statically stable in the heat shield forward attitude.

b. Correct attitude during the re-entry phase shall be facilitated by use of a destabilizer flap located on the top of the antenna fairing opposite the roll axis horizon scanner.

c. Supersonic launch and escape drag shall be reduced by use of an aerodynamic spike and ballast assembly located on top of the escape rocket structural assembly.

d. Re-entry forebody shape effect on water and land impact loads.

e. Design landing condition of the capsule has been based on impacts on both water and land within the structural design parameters defined in M.A.C. Report No. 6693, revised 3 August 1960.

f. The capsule shall be buoyant and hydrodynamically stable upright in the water, impact skirt and heat shield assembly down, and shall be capable of righting itself.

3.4 STRUCTURAL DESIGN CRITERIA - Structural design criteria of the Mercury capsule shall be as defined in M.A.C. Report 6693, revised 3 August 1960 and Paragraphs 2.4 through 2.4.2.5 of NASA Specification S-6 revised 26 January 1959.

3.5 CAPSULE

3.5.1 DESCRIPTION - The Mercury No. 16 capsule shall be of conical configuration having an extremely blunt forebody with booster adapter attachment fittings and an afterbody which tapers to a juncture with a cylindrical section. The cylindrical section shall support a truncated antenna cone and escape system pylon and rockets. The contours of the forebody shall be such as to provide the maximum practical wave drag and uniform heating consistent with other requirements. The afterbody configuration shall augment stability and provide adequate volume, and low heating as well as requirements for parachute stowage and escape system attachment. Internal volume of Capsule No. 16 shall be identical to the ultimate capsule which shall be based on a human occupant five feet ten and one-half inches (5'10-1/2") tall and weighing one hundred and eighty (180) pounds.

3.5.2 CONSTRUCTION - The capsule shall be of semimonocoque construction consisting of a conical and a cylindrical section. The conical section shall consist of an unbeaded inner skin which shall be seam welded to a beaded outer skin with 24 equally spaced longitudinal stringers. Two bulkheads shall form the pressurized cabin area. The cylindrical section has a single skin with 12 equally spaced stringers and internal shear webs which support the parachutes. The capsule structure shall be protected from heat, noise, and micrometeorites by insulation, an outer covering of shingles, and a fiberglas heat shield, which shall ablate during re-entry.

3.5.3 ENTRANCE AND EMERGENCY EGRESS HATCH - The entrance and emergency egress hatch in accordance with Drawing No. 45-35003, located in the capsule conical section, shall be trapezoidal in shape as dictated by the capsule configuration (see Figure 1). The hatch assembly shall be of construction similar to the basic capsule structure, designed to permit entry into, and emergency egress from, the capsule. An explosive assembly, in accordance with Drawing No. 45-35701, shall be incorporated in the hatch assembly to serve as a means, when ignited, of breaking the seventy (70) hatch attachment bolts. The explosive assembly shall be mounted about the hatch perimeter and shall consist of a gasket type sill containing a continuous single strand of explosive charge to effect severance of the attachment bolts. The strand shall be ignited from both ends simultaneously to provide redundancy. A push-button initiator, located on the hatch interior to the astronaut's upper right, shall, after removal of a safety cap and pin, ignite the explosive charge when pushed by the astronaut. A pull initiator assembly shall be provided for ground rescue utilization on the exterior of the hatch beneath the shingles. Function of the pull initiator assembly shall be the same as for the astronaut actuated initiator. The hatch assembly shall be secured to the capsule structure by two wire springs in accordance with Drawing No. 45-35058. These springs shall absorb the energy expended by the explosive charge and serve to prevent injury to personnel working in the hatch area during recovery operations. A cabin pressurization fitting assembly shall be located at approximately Z123.00 between stringers six and seven. This assembly shall provide the necessary inlet and outlet ports for a ground leakage check of the hatch seal prior to launch. Upon completion of the leakage check, the ports shall be sealed.

3.5.4 EXIT HATCH - The exit hatch, in accordance with Drawing No. 45-32023, shall be located in the small afterbody pressure bulkhead. The hatch shall be dish-shaped and shall be an inward opening, plug-type hatch of reinforced aluminum construction. The hatch shall be held in place by a retaining ring which, when latched in place, shall cause the hatch to seal to the small pressure bulkhead. The retaining ring shall consist of

3.5.4 EXIT HATCH - (Continued)

a partial ring so that as the latch handle is actuated to the closed position, the ring is expanded to form a tight seal. As the latching handle linkage is moved to the open position, the expansive force shall be released. In order to facilitate egress through the exit hatch, the right section of the instrument panel shall be designed for removal. The periscope housing may be used as a step during egress. The exit hatch shall remain operable after a normal land impact.

3.5.5 WINDOWS AND COVERS

3.5.5.1 WINDOW - An observation window assembly shall be provided for astronaut visual observation of the space environment. This assembly shall be located in the afterbody conical section forward of and above the astronaut's head from stations Z124.81 to Z144.80. The window assembly shall consist of an outer window assembly in accordance with Drawing No. 45-35030 and an inner window assembly in accordance with Drawing No. 45-35035. Window shape shall be trapezoidal as dictated by the capsule conical configuration with the base of the trapezoid toward the heat shield end as indicated in Figure 1 herein. The outer window assembly shall consist of a single pane of 0.350 inch Vycor glass contoured to the capsule structural shell curvature. The outer pane shall possess grade 2N optical fidelity in its two critical areas. Grade 2N glass shall permit an optical deviation of two minutes of arc. Location of critical areas shall be such as to be compatible with reference sight lines on the inner window assembly. The outer pane shall be mounted in a structural frame with suitable sealing gaskets on the inner and outer surfaces and with spacers supporting the edge inside the frame. The inner window assembly shall consist of three flat panes of glass of the trapezoid configuration and each pane shall have an optical fidelity of grade 2N. The two inner panes shall be 0.340 inch tempered glass and the outermost pane of the inner window assembly shall be 0.170 inch Vycor glass. The outermost pane shall contain lateral reference sight lines on the inner and outer surfaces as required by the window mounting angle and the fixed optical reference point. The set of lines near the base of the trapezoidal pane shall provide an eye level sight reference for viewing the horizon compatible with a capsule attitude of thirty-four (34) degrees with heat shield up. The second set of lines shall provide an eye level reference for viewing the horizon compatible with a capsule attitude of fourteen and one-half (14.5) degrees from horizontal with heat shield up. The inner window panes shall be mounted in individual supporting rings, independently sealed by gaskets on upper and lower surfaces, and held firm by spacers around the edge inside the ring. The outer pane of the inner window assembly shall be capable of withstanding the environmental conditions normally encountered by the outer window assembly. The pane assemblies shall be supported by a structural frame which shall be attached and sealed to the capsule inner structure. The inner surface

3.5.5.1 WINDOW - (Continued)

of the outer window pane and both surfaces of the inner window assembly panes shall be coated with a single layer of magnesium fluoride (MgF_2) film for impeding thermal radiation into the cabin. A light-polarized, transparent filter, in accordance with Drawing No. 45-86034, shall be provided and retained on the inner frame of the observation window for multiple image suppression and improvement of observation characteristics. Provisions shall be incorporated for reduction of glare from the window supporting structure and adjacent areas.

3.5.5.2 COVER - A cover and filter assembly, in accordance with Drawing No. 45-86005, shall be provided for the observation window. This assembly shall be mounted on the inner window assembly as described in Paragraph 3.5.5.1 and shall offer protection from solar radiation and boundary layer effects during the re-entry phase. The cover assembly shall consist of a right and left door of aluminum alloy, honeycomb core, construction configured to the shape of the trapezoidal window assembly. Each door shall be hinged on its outboard side and shall contain a latching mechanism and handle for actuation. The doors shall be retained in the outboard, open position by latches located on each side of the capsule. The filter assembly shall consist of a right and left plexiglas panel 0.080 inch thick configured to the shape of the window assembly. Each plexiglas panel shall be hinged on its outboard side and shall contain a rubber sealing strip about the inboard and lower edges. The filters shall be retained in the closed position by a spring-loaded latch located above and forward of the astronaut's head. The astronaut must pull the latch assembly in order to release the filters to the open position where they may be latched on each side of the capsule with the cover assembly doors. The filter plexiglas panels shall be red in color to afford the astronaut a means of adapting from a night-day environment. The filter panels shall possess optical quality equal or superior to Plex II in accordance with Specification MIL-P-5425B, Finish A, except for the light transmissibility characteristics required for filtering capabilities. An extended view mirror assembly shall be provided with the cover assembly. The mirror assembly shall be located on the lower end of the inner window assembly and shall mate with the filter assembly sealing strips. The mirror shall be of aluminum alloy construction with a reflecting surface which shall permit a maximum image shift approximating 0.09 inch at twenty-five (25) feet when viewed at eighteen (18) inches. The mirror shall contain a ring-type handle for the astronaut to grasp when an extended view of the horizon is desired. The cover and filter assembly shall be accessible to the astronaut in the fully restrained and pressurized condition. A window pole assembly in accordance with Drawing No. 45-81092 shall be provided to assist the astronaut in actuation of the cover and filter assembly latches. The window pole assembly shall be retained on the capsule inner structure by a spring detent which shall be located to the astronaut's left. The handle of the pole shall be attached to the capsule by a cord.

3.5.6 ANTENNA ASSEMBLY - A communications antenna, in accordance with Drawing No. 45-31003, shall be installed between the cylindrical recovery compartment and the escape tower, and shall extend from station Z184.57 to Z208.57. The antenna fairing shall house the pitch and roll horizon scanners and the drogue parachute. An eight-inch window assembly, in accordance with Drawing No. 45-31016, shall be located around the outer base of the antenna fairing and shall act as a dielectric for the main biconical antenna. A destabilizer flap assembly, in accordance with Drawing No. 45-31026, shall be hinged to the upper extremity and outer edge of the antenna structural assembly opposite the roll horizon scanner, and shall prevent the capsule from becoming stable with the antenna fairing forward. The destabilizer flap and horizon scanner cover (see Paragraph 3.10.2) shall be combined into a single structural unit, spring loaded to the outboard position and tethered to the antenna fairing by a nylon cord. At tower jettison, nylon lanyards attached to the tower structure shall actuate two 4-second time delay reefing cutters, which shall sever the tie-down cord and release the destabilizer flap/scanner cover assembly for erection to its functional position. The antenna fairing shall be automatically jettisoned from the capsule as the capsule descends to 10,000 feet altitude. (See Paragraph 3.17.1.2).

3.5.7 ANTENNA COVER - An antenna cover assembly, in accordance with Drawing No. 45-31036, shall be incorporated in the escape tower structural assembly. The cover assembly shall shield the antenna assembly and horizon scanners during the launch phase. The cover assembly, being an integral part of the tower, shall permit horizon scanning following tower separation.

3.6 HEAT AND MICROMETEORITE SHIELDING

3.6.1 FOREBODY HEAT PROTECTION - The capsule shall be protected by a dish-shaped ablative type heat shield which shall form the forward surface (forebody) of the capsule. The heat shield, in accordance with Drawing No. 45-32052, shall be designed to ablate and shall be constructed of fiberglas shingles laminated to form a smooth contour in its final size of 74.44 inches diameter with a spherical radius of 80 inches. Design consideration has been given to landing loads on the heat shield to insure that the pressure vessel is not punctured on water landings and that internal equipment is not damaged upon land impact. The heat shield shall be designed for retention on the capsule until actuation of the impact bag extend valve and the heat shield release mechanism, Drawing No. 45-32301. The heat shield shall be attached to the capsule conical structure assembly (afterbody) by a titanium heat shield attach ring, Drawing No. 45-32031. The attach ring, riveted to the capsule structure assembly, shall contain 48 elongated holes (to allow for thermal expansion) to mate with bolt holes spaced about the rim of the heat shield. There shall be 24 locking type studs alternated with 22 guide studs and two holes remaining unused beneath the release mechanism actuators. Actuation of the heat shield release mechanism shall initiate withdrawal of the "U"-shaped lugs, releasing the 24 lock studs and the heat shield from the capsule structure assembly.

3.6.2 AFTERBODY HEAT PROTECTION - Afterbody heat protection shall consist of shielding on the outside surface with insulation between the shielding and the primary structure. The shielding used shall be shingles of 0.016 inch thick Rene' 41 on the conical section and antenna fairing and 0.220 inch thick beryllium on the cylindrical section. Both the Rene' 41 and beryllium shingles shall be installed to allow thermal expansion while remaining within acceptable flutter limits. The insulation used between the shielding and the primary structure shall minimize thermal leakage and serve to attenuate the external noise reaching the capsule interior.

3.6.3 MICROMETEORITE PROTECTION - Protection of the underlying pressure vessel and recovery compartment against impacts from micrometeorites shall be provided by the use of the outer shielding skin specified above.

3.7 MISSILE ADAPTER - M.A.C. shall be responsible for matching the Mercury capsule to an Atlas D missile, the Mercury booster vehicle (HS-36). The capsule shall replace the missile nose cone in a manner which requires a minimum of modification to the booster system. The booster adapter, in accordance with Drawing No. 45-33002, for mating the Mercury capsule to the booster vehicle shall be of conventional semimonocoque alumimum, steel, and titanium construction. The adapter shall consist of a machined structural frame utilizing a capsule match ring and a missile adapter ring, with titanium sheet metal skin reinforced by longitudinal hat sections

3.7 MISSILE ADAPTER - (Continued)

spaced about the outer surface. The adapter shall have ventilation provisions for booster vehicle LOX environmental relief and pressure equalization during launch. An access door shall be provided between the intermediate rings diametrically opposite the LOX valve openings for access to the booster nose and the capsule heat shield area while on the launch pad. The adapter shall be attached to the capsule by a clamp ring installation in accordance with Drawing No. 45-72100. The clamp ring installation shall consist of three (3) segmented sections joined by three (3) explosive tension bolts. Two (2) explosive bolts can be initiated electrically from either end by a dual electrical system. The third explosive bolt may be initiated electrically from one end and by an initiator system which shall be used to supply a compressed gas to the opposite end for initiating a percussion cap. Automatic capsule-adapter separation shall be initiated by placing the SQUIB ARM switch on the main instrument panel in the ARM position prior to launch. Upon sustainer engine thrust decay to 0.20g as sensed by the capsule contained cutoff sensor, the 0.20g contacts shall close, energizing the capsule-adapter clamp ring bolts power relay, which shall initiate detonation of the explosive bolts. Separation of the clamp ring bolts shall close the capsule-adapter ring separation limit switches. This action shall initiate a firing signal to the posigrade rockets (see Paragraph 3.11.4). In event the automatic system does not function as indicated by the telelight sequence system (see Paragraph 3.8.9.4), the override control may be used. This override control shall consist of a pull ring which must be actuated by the astronaut. Pulling the ring shall actuate a limit switch which shall energize a redundant electrical system for detonation of two (2) of the explosive bolts and shall actuate an initiator for firing the third explosive bolt. Detonation of any one explosive bolt shall separate the clamp ring. Capsule-adapter separation can be initiated by ground command (G-1 on the sequential schematic, Figure 6, Page 76) through abort circuitry.

3.8 CREW STATION - The location and actuation of all astronaut operated controls, and the arrangement of instruments and warning devices shall be in accordance with good human engineering practice. Restrictions imposed on the astronaut by the restraint system, pressure suit and acceleration forces have been considered in crew station design.

3.8.1 ASTRONAUT SUPPORT COUCH - Each astronaut shall be provided with an individually-molded support couch consisting of a contoured seat assembly in accordance with Drawing No. 45-82000 and leg restraint assembly in accordance with Drawing No. 45-82002. Seat and leg restraint assemblies shall be shipped from the contractor's plant to the launch site for installation. The seat assembly shall support the astronaut's torso, arms to a point just below his elbows, and head. The leg restraint assembly shall support his thighs and calves. Left and right hand arm rests shall be provided with the seat installation. Each seat shall be fabricated in accordance with M.A.C. Process Specification 14043.

3.8.1.1 CONSTRUCTION - Seat construction primarily shall be of glass-fiber plastic laminate in accordance with M.A.C. Material Specification MMS-501, aluminum-alloy honeycomb core in accordance with M.A.C. Material Specification MMS-701, glass-fabric laminate, aluminum-alloy, plastics, fiberglas and lockfoam filler. Each seat assembly shall consist of an inner liner and outer shell assembly with the area between filled with lockfoam plastic. The inner liner shall be of glass-fiber plastic laminate and glass-fabric laminate molded to the astronaut's body as specified in the preceding paragraph. The outer shell shall be constructed of laminate-skin, honeycomb-core sandwiches formed to the curvature of the large pressure bulkhead on the back, to the contour of the inner liner on the bottom, roughly to the astronaut's helmet and shoulders on the head assembly, and to the vertical seat support beam assemblies to the left and right of center. The sandwiches shall be joined by formed laminate skin, plastic compound filled angles, and aluminum-alloy rub strips. A glass-fiber plastic laminate support fitting shall be provided on each side of the seat assembly. The leg restraint assembly shall be constructed of glass-fiber plastic laminate, glass-fabric laminate, fiberglas, aluminum-alloy and lockfoam plastic filler. Each leg restraint assembly shall consist of inner liners and outer shell support assemblies with the area between filled with lockfoam plastic. The inner liners shall be constructed of glass-fiber plastic laminate and glass-fabric laminate molded to the astronaut's body as specified in the preceding paragraph. The outer shell support assemblies shall consist of formed aluminum-alloy thigh supports and formed fiberglas leg supports. The thigh portions of the restraint assembly shall be hinged to the seat and calf restraint assemblies, and the calf restraints shall be hinged at the ankle ends. Hinging of these assemblies shall permit installation through the entrance hatch.

3.8.1.1 CONSTRUCTION - (Continued)

Loads from the astronaut shall be transmitted through the inner liners which shall act as distribution panels to the honeycomb structure. Crushable support assemblies constructed of aluminum alloy honeycomb glass-fiber laminate shall be installed between the large pressure bulkhead and the seat assembly. The honeycomb-core construction employed in the seat support assemblies shall decrease the loading on the astronaut due to excessive positive transverse accelerations and provide adequate protection against physiological damage and loss of consciousness when subjected to peak positive accelerations as directed by the mission defined in Paragraph 1.1.1 herein. The seat design shall be such as to provide adequate support under conditions of lateral acceleration.

3.8.2 ASTRONAUT RESTRAINT SYSTEM - The astronaut shall be firmly restrained in the support couch by a restraint harness assembly in accordance with Drawing No. 45-82702. The restraint harness shall provide satisfactory support for conditions of maximum acceleration and shall consist of two shoulder harness assemblies, a chest strap, a lap belt assembly, an inverted "V" crotch strap assembly, and a knee belt assembly. Webbing shall be of dacron material in accordance with Specification MIL-W-25361. The shoulder harnesses shall be of the conventional type and shall be held in tension automatically by spring-loaded reels. During ascent and descent, the reels shall be locked in the fully restrained position to prevent astronaut movement out of the support couch. When unlocked for the normal restrained position, the reels shall provide a light restraining force to aid positioning and to provide the astronaut with proprioceptive cues during weightless flight. Reel locks shall be disengaged by actuation of a control lever located to the upper left of the seat assembly. The lap belt shall be of conventional type with a center coupling. Eyelets on the shoulder harness straps and inverted "V" crotch strap shall loop the lap belt coupling so that disconnecting the lap belt coupling will release lap belt, shoulder harness, and crotch straps. The lap belt shall have quick release fittings on each end for ease of installation in the capsule. Leg restraint shall be provided by a knee belt assembly consisting of dacron straps formed to knee cups with retainer straps on each side attached to fittings on the seat assembly and to a fitting located at a central point (Station X0.00) between the astronaut's legs. Toe restraint shall be provided by the couch and by insertion of the astronaut's flight boots into toe restraint supports in accordance with Drawing No. 45-32207 and constructed of laminated plastic conforming to M.A.C. Material Specification MMS-501. Arm and hand restraint shall be provided by the astronaut's gripping the manual control handle to his right and the abort handle to his left.

3.8.3 ASTRONAUT APPAREL - The pressure suit, helmet, and parachute harness worn by the astronaut shall be furnished by NASA. The pressure suit shall be a Goodrich-Mercury type and shall include connections to mate with capsules for biomedical measurements, oxygen breathing and face piece seal lines and communications.

3.8.4 FOOD AND WATER - The contractor shall make installation provisions in accordance with Drawing No. 45-81231 for a food container to be furnished by NASA. (See Appendix I-A.) The container shall allow proper storage and dispensing during flight and shall be located to the astronaut's right between the hand controller and right-hand console. Food shall be of the low residue type and shall be furnished by NASA for the mission as defined in Paragraph 1.1.1. A 2500 CC NASA furnished water bladder shall be installed in the survival kit (see Paragraph 3.17.4). The water contained in this bladder shall be available to the astronaut for use during the mission through a retracting drinking tube which shall be stowed in a pocket along the upper edge of the survival kit. The survival kit shall also contain a desalting kit for water supply after a water landing (see Paragraph 3.17.3). Contents of the environmental control system coolant and condensate tanks may be used as a water supply after landing by severing the closed end of a tube attached to either tank.

3.8.5 WASTE HANDLING - Provisions shall be made for urine collection within the pressure suit. A canvas bag assembly with a waterproof inner bag assembly, in accordance with Drawing No. 45-81230, shall be provided, mounted on the hatch for use by the astronaut in event nausea is experienced during any phase of the mission.

3.8.5.1 KNIFE INSTALLATION - A knife installation shall be provided in accordance with Drawing No. 45-81102 and shall be mounted on the hatch assembly to the upper right of the astronaut. The knife shall be retained in its bracket assembly by a retention strap and to the hatch by a spring. The knife shall be attached to its bracket assembly by a cord assembly which shall prevent the knife from floating while in a weightless condition if it becomes detached from the retention strap and spring. The knife shall be furnished by NASA (see Appendix I-A).

3.8.5.2 FLASHLIGHT INSTALLATION - A flashlight installation shall be provided in accordance with Drawing No. 45-81098. The flashlight shall be mounted on the capsule inner structure forward and to the left

3.8.5.2 FLASHLIGHT INSTALLATION - (Continued)

of the astronaut. The flashlight shall be retained in a bracket assembly and spring-clip type stop. A cord assembly shall be attached to the flashlight and its supporting bracket assembly. This shall prevent the flashlight from floating while in a weightless condition. The flashlight shall be furnished by NASA (see Appendix I-A).

3.8.6 NOISE AND VIBRATION - The anticipated noise level which shall reach the astronaut is estimated to be below 135 decibels during maximum "g" conditions. Noise levels shall be attenuated by the cabin insulation and by the astronaut's apparel. The noise attenuation provided shall be great enough to permit two-way communication by proper selection of microphones and earphones. Vibrations imposed shall be lessened by absorption within the support couch structure.

3.8.7 AEROMEDICAL SENSING EQUIPMENT - Aeromedical sensing equipment shall be as specified in the following paragraphs. Instrumentation shall be as specified in Paragraph 3.8.9 and as depicted in Figure 8, Page 93.

3.8.7.1 ELECTROCARDIOGRAM - Indications of EKG shall be provided by four normal leads which shall provide two outputs for transmission on each telemetry system. One output shall be derived from a left side and a right side lead; and the other output from an upper chest and a lower chest lead.

3.8.7.2 RESPIRATORY MEASUREMENT - Respiratory measurement shall be made by means of a thermistor sensor mounted on the astronaut's microphone.

3.8.7.3 BODY TEMPERATURE - A rectal temperature pickup shall be provided for recording the astronaut's body temperature.

3.8.7.4 BLOOD PRESSURE MEASURING SYSTEM - Provisions for installation of a blood pressure measuring system in accordance with Drawing No. 45-88727 shall be provided. This system shall be capable of measuring the astronaut's blood pressure and converting this pressure measurement into an electrical signal. Blood pressure shall be continuously monitored during launch and re-entry. During the remainder of the mission, the system shall be actuated by the programmer (see Paragraph 3.15.4) or manually by the astronaut by a blood pressure START push button located on the right side of the main instrument panel. The system may be interrupted at any time by the astronaut by actuation of a STOP push button adjacent to the START push button.

3.8.8 CONSOLES AND CONTROLS

3.8.8.1 CONSOLES

3.8.8.1.1 RIGHT-HAND CONSOLE - The right-hand console, in accordance with Drawing No. 45-81002, shall contain controls for cabin temperature, suit temperature and oxygen supply. These controls shall be accessible to the astronaut while in the fully pressurized condition. The right-hand console shall be finished in light blue space capsule coating XA-266 compatible with the life support color code as applied to the main instrument panel.

3.8.8.1.2 LEFT-HAND CONSOLE - The left-hand console, in accordance with Drawing No. 45-81110, shall consist of two panels; the inner panel adjoining the instrument panel which shall contain the ABORT light, LAUNCH CONTROL switch, pressure regulator waterseal handle for sealing the cabin pressure relief valve against water leakage, and sequence system with manual override controls (see Paragraph 3.8.9.4); and, the outer panel which shall contain the SQUIB ARM switch, AUTO RETRO JETTISON arm switch, ASCS MODE SELECT switches, ASCS fuel controls, RETRO DELAY switch, pressurization controls, RESCUE AIDS switch, LO-FREQ TELEMETRY switch, PHOTO LIGHTS and CABIN LIGHTS switch. The left-hand console inner panel shall be finished in light brown space capsule coating XA-263 and the outer panel shall be finished in dark brown space coating XA-264, except for the pressurization controls area which shall be finished in light brown XA-263. The DECOMP handle shall be finished in red space capsule coating XA-214 and the REPRESS handle shall be finished in white space capsule coating XA-213.

3.8.8.2 CONTROLS - In addition to the console controls specified in the preceding paragraphs, the astronaut shall be provided with an abort handle to his left and with a manual control system hand controller to his right.

3.8.8.2.1 HAND CONTROLLER - The manual system hand controller, in accordance with Drawing No. 45-61010, shall provide the astronaut a means of manually controlling the capsule attitude in three axes. The hand controller shall be operable by the astronaut while in the restrained condition through wrist articulation and palm pivot motion only, but shall be structurally designed for full astronaut effort. The hand controller shall be a stick-grip type control providing a firm hand hold for the astronaut. Latching of the hand controller shall be provided by a ground safety pin which shall be removed prior to launch. The hand controller shall be mass balanced such that accelerations up to three "g" which are perpendicular to the capsule axis of symmetry do not effect control system movement. The manual control system hand controller shall be designed to minimize longitudinal acceleration control forces, and shall be spring-loaded to provide a feel system. By switching the ASCS MODE SELECT switch (P-19 on the sequential

3.8.8.2.1 HAND CONTROLLER - (Continued)

schematic, Figure 6, Page 76) to the FLY-BY-WIRE position, the astronaut may selectively energize the solenoid valves of the automatic reaction control subsystem through limit switches actuated by the hand controller. This shall provide the "fly-by-wire" mode through utilization of automatic control system fuel while bypassing the system's inherent electronics (see Paragraph 3.10.1.1). Controller motions of approximately 25 percent and 75 percent of travel shall activate the small and large thrust reaction control solenoid valves respectively. The hand controller shall be connected to the modulated manual control throttle valves in the reaction control system by conventional linkage which shall be covered with fabric boots to provide protection from fouling by floating debris.

A "mechanical fuse" type linkage shall be incorporated in one bellcrank in each axis (pitch, roll, and yaw) to prevent loss of "fly-by-wire" control mode in that axis due to an inoperative throttle valve. This linkage shall consist of a two-piece, pivoted bellcrank, retained in its rigid configuration by an aluminum pin, which may be sheared by the astronaut if necessary by applying additional force to the hand controller.

Total nominal travel of the hand controller shall be $\pm$13 degrees from neutral in roll and pitch axes and $\pm$10 degrees in the yaw axis. Actuation in an up and down direction, about a pivot at the wrist, shall provide an upward and downward movement about the capsule pitch axis. Rotary displacement in a clockwise or counterclockwise direction, in a transverse plane with respect to the pivot point below the astronaut's wrist, shall provide a similar movement about the capsule roll axis. Actuation of the stick grip by palm pivot motion in a right or left direction shall provide a similar movement about the yaw axis (see Figure 4, Page 52).

3.8.8.2.2 ABORT HANDLE - The abort handle, in accordance with Drawing No. 45-61002, shall provide the astronaut with a means of manually initiating the escape sequence. The abort handle shall be located on the astronaut's left and shall be operable by the astronaut while in the restrained condition. The handle shall be a stick type, flanged at the upper extremity to prevent the astronaut's hand from inadvertently slipping off. A recessed unlock button, which must be depressed to release the handle for actuation, shall be located on the top. A microphone button, accessible for thumb operation, shall be provided on the upper end of the handle adjacent to the handle release button. The handle, when rotated twenty-seven degrees in a counterclockwise direction about its pivot point, shall initiate the escape sequence.

3.8.9 INSTRUMENTATION AND DISPLAYS - A main instrument panel assembly, in accordance with Drawing No. 45-81100, shall be provided for astronaut indication of emergency, environment, vehicle and operational measurements. The instrument panel shall be supported from capsule structure and

3.8.9 INSTRUMENTATION AND DISPLAYS - (Continued)

by the periscope housing (see Paragraph 3.16.1). The instrument panel shall extend around both sides and the top edge of the periscope such that the scope display shall appear in the lower center of the instrument display. This installation shall provide an optical reference point which falls at the intersection of stations Z135.59 and TY 5.780. All instruments shall have white indices on black background. The instrument panel shall be coded to indicate specific functional areas by color. These shall be as follows:

FUNCTION	SPACE CAPSULE COATING
Life Support	Light Blue XA-266
Electrical	Light Green XA-267
Radio	Dark Green XA-269
Warning	Medium Green XA-268
Flight	Light Grey XA-265
Altitude and Descent	Tan XA-262
Fuel Indication	Dark Brown XA-264

Basic instrumentation, depicting transmitting and/or recording methods for obtaining measurements defined below, are as illustrated in Figure 8, Page 93. Instrumentation specified below shall be provided by the contractor except for cosmic ray recorders which shall be furnished by NASA.

(a) Aeromedical	Astronaut's Indication	Recording Method (See Figure 8)
Electrocardiogram	-	X
Blood Pressure	-	X
Respiratory Rate	-	X
Body Temperature	-	X
Astronaut Motion and Appearance	-	X
Voice Recording	-	X

3.8.9 INSTRUMENTATION AND DISPLAYS - (Continued)

(b) Capsule Environment	Astronaut's Indication	Recording Method (See Figure 8)
Primary and Secondary O_2 Supply Pressure	X	X
O_2 Partial Pressure	X	X
Cabin Pressure	X	X
Cabin Air Temperature	X	X
Instrument Panel Recording	-	X
Coolant Quantity	X	X
Pressure Suit Inlet Air Temperature	X	X
Humidity	X	X
Suit Pressure	X	X
(c) Vehicle Measurements		
Acceleration (See Paragraph 3.8.9.3)	Long. Only	X
Time Reference (See Paragraph 3.8.9.1)	X	X
Static Pressure	-	X
Structural Temperatures	-	X
Equipment Temperatures	-	X
Astronaut Control Motions (Pitch, Roll and Yaw)	-	X
Stabilization Control Motions (Pitch, Roll and Yaw)	-	X

3.8.9 INSTRUMENTATION AND DISPLAYS - (Continued)

	Astronaut's Indication	Recording Method (See Figure 8)
Visual Attitude Reference (See Paragraph 3.16.1)	X	X
Attitude and Angular Rate (See Paragraph 3.8.9.2)	X	X
Altitude (Altimeter)	X	X
Dead Reckoning Earth Path (See Paragraph 3.8.9.5)	X	X
Rate of Descent	X	X
Retrograde Cover Jettison (Retro-Rocket Firing) (See Paragraph 3.11.3)	-	X
Periscope Door Position	-	X
(d) Operational Measurements		
AC Voltage	X	X
DC Voltage	X	X
DC Current	X	X
Sequence of Events and System Malfunction (See Paragraph 3.8.9.4)	X	X
Fuel Quantity	X	X

3.8.9 INSTRUMENTATION AND DISPLAYS - (Continued)

	Astronaut's Indication	Recording Method (See Figure 8)
Horizon Scanner Operation	-	X
ASCS Slaving Signal	-	X
Instrumentation Calibration Signal	-	X
Command Receiver Signal Strength	-	X
(e) Scientific Observations		
Cosmic Radiation	-	X
(f) Emergency Warnings		
Cabin Pressure	X	X
O_2 Quantity	X	X
O_2 Emergency	X	X
Excess Suit H_2O	X	X
Excess Cabin H_2O	X	X
Fuel Quantity	X	X
Retro Warning	X	X
Retro Reset	X	X
Standby AC-Auto	X	X

3.8.9.1 SATELLITE CLOCK - A satellite clock, in accordance with Drawing No. 45-81710, shall be provided. This clock, a spring-driven chronometer, shall indicate time of day, elapsed time from launch, retrograde initiation time, and time remaining until retrograde initiation. A "time zero" reference shall be established in the clock at liftoff. The retrograde timing mechanism shall provide a retrograde fire signal for

3.8.9.1 SATELLITE CLOCK - (Continued)

retrograde initiation. Signals of elapsed time from "time zero" and retrograde time shall be transmitted to telemetry as indicated in Figure 8, Page 93. The retrograde set device, which may be reset manually or by ground signals, shall provide ground monitored automatic retrograde firing. A "time-to-go" light shall be internally lighted yellow for a period of 5 minutes prior to retrograde initiation.

3.8.9.2 ANGULAR RATE AND ATTITUDE INDICATOR - A combined angular rate and attitude indicating system shall be provided in accordance with Drawing No. 45-81721. The indicator shall show pitch, roll and yaw angles and angular rates. Pitch angles shall be indicated in the range of -130 degrees to +190 degrees. Yaw angles shall be indicated in the range of -70 degrees to +250 degrees. Roll angles shall be indicated in the range of -130 degrees to +190 degrees. The pitch needles shall be color coded pink, the yaw needles shall be color coded yellow, and the roll needles shall be color coded flat white. Colors shall be in accordance with FED-STD-595. The attitude portion of the indicator shall be driven by signals obtained from the automatic stabilization and control system (see Paragraph 3.10.1). Pitch and yaw rate transducers shall have a full scale output of ± 6 degrees per second. Roll rate transducers shall have a nominal full scale output of ± 6 degrees per second, switchable to ± 15 degrees per second by an external switch. The orbit and retrograde index point on the indicator shall be aligned with the zero pitch rate at 34 degrees (heat shield up) on the pitch indicator dial. The indicator shall provide the astronaut with necessary indications so that he may damp out dynamic oscillations in event of malfunction of the automatic stabilization and control system.

3.8.9.3 ACCELERATION INDICATION - An accelerometer, in accordance with Drawing No. 45-81702, shall be provided for the longitudinal axis only. The accelerometer shall be a modification of the Specification MIL-A-25719 type and shall include positive and negative "g" memory pointers.

3.8.9.4 SEQUENCE SYSTEM AND OVERRIDE CONTROLS - The sequence system shall consist of engraved nameplates and telelight sequence lights with adjacent manually operated override controls. This system shall indicate functional sequence of events by illumination of a green light for normal sequential operation or, after a time delay, by a red light indicating a malfunction and need for subsequent override action. After corrective

3.8.9.4 SEQUENCE SYSTEM AND OVERRIDE CONTROLS - (Continued)

action has been taken, the telelight shall illuminate green as in normal sequential operation. In order of chronology, the following shall appear on the left-hand console:

NOMENCLATURE	CONTROL TYPE	SWITCH NO.	PRESENTATION
Launch Control	Toggle Switch	P-1	Engraved Nameplate
Jett Tower	Pull Ring	P-3	Telelight
Sep Capsule	Pull Ring	P-4	Telelight
Retro Seq	Push Button	P-6	Telelight
Retro Att	Toggle Switch	P-8	Telelight
Fire Retro	Push Button (with plastic cover)	P-7	Telelight
Jett Retro	Push Button (with plastic cover)	P-10	Telelight
Retract Scope	Toggle Switch	P-20	Telelight
.05g	Push Button	P-11	Telelight
Drogue	Push Button	P-12	Engraved Nameplate
Snorkel	Pull Ring	----	Engraved Nameplate
Main	Pull Ring	P-13	Telelight
Reserve	Pull Ring	P-14	Engraved Nameplate
Landing Bag	Toggle Switch (with Switch Guard)	P-25	Telelight
Rescue	Toggle Switch (with Switch Guard)	P-15	Telelight

Switch numbers represent manual override controls and correspond to those indicated in the sequential schematic, Figure 6, Page 76.

3.8.9.4 SEQUENCE SYSTEM AND OVERRIDE CONTROLS - (Continued)

The pull ring override controls on the left-hand console shall provide override functions by dual independent electrical systems or by pyrotechnic initiators. The guarded push button controls shall provide override control by a dual electrical system for each function designated. The guarded toggle switches shall function in a left-right direction and their nomenclature shall be as follows (in order of sequence and left-right readings):

LAUNCH CONTROL	READY-OFF
RETRO ATT.	AUTO-BYPASS
RETRACT SCOPE	AUTO-MAN
LANDING BAG	AUTO-OFF-MAN
RESCUE	AUTO-MAN

The telelight assemblies, in accordance with Drawing No. 45-79720, shall be rectangular in shape and shall consist of red and green light assemblies, nomenclature caps and retention clips. Legends shall be direct reading, engraved in black on frosted glass plate nomenclature caps and shall be readable when the lights are de-energized. Colors shall be in accordance with FED-STD-3. Brightness of the lights shall be as required by MIL-STD-411 for 24-volt application.

The engraved nameplates shall be constructed of aluminum material and shall simulate the telelight assemblies in form and size. Nomenclature on the nameplates shall be white on a black background.

3.8.9.4.1 WARNING LIGHTS - Warning lights shall be provided on a warning light panel, located on the right-hand side of the main instrument panel, except for the ABORT light which shall be located on the left-hand console above the sequence system. This light shall be a round presentation, 1.5 inches in diameter, and shall indicate red when energized by abort command circuitry. The legend on the ABORT light shall appear dull white on a dark background when the light is de-energized. Warning telelight assemblies shall be rectangular in shape and shall consist of amber light assemblies,

3.8.9.4.1 WARNING LIGHTS - (Continued)

nomenclature caps and retention clips. These shall be identical to the telelight assemblies as specified in Paragraph 3.8.9.4 except for legends and color of lights. The following warning lights shall appear:

CABIN PRESSURE	EXCESS SUIT H_2O
O_2 QUANTITY	EXCESS CABIN H_2O
O_2 EMERGENCY	FUEL QUANTITY
RETRO WARN	STANDBY AC AUTO*
RETRO RESET	

* This has no corresponding audio tone signal.

As a warning light circuit becomes energized, a tone generator is initiated, resulting in a steady tone audible to the astronaut through his headset. The steady tone shall remain audible until the astronaut takes action to move the corresponding toggle switch in an inboard direction to the OFF position. The switches normally shall be set in the TONE position in order to permit the tone generator to be automatically audible. After a tone has been discontinued, the astronaut shall be required to place the switch in the TONE position for reset in event another warning occurs in that particular circuit.

3.8.9.5 DEAD RECKONING EARTH PATH INDICATION - A dead reckoning earth path indicator, in accordance with Drawing No. 45-81722, shall be provided in the instrument panel as indicated in Figure 3, Page 51. This indicator shall be a spring-driven unit requiring no electrical power and shall display the earth path by use of a gimballed globe approximately 3.85 inches in diameter. The globe (earth) shall rotate in a manner such that the location of the capsule relative to ground position appears beneath an index point in the center of the display. Touchdown point shall be indicated by a parallelogram on the cover glass and a white index point behind it. Control knobs shall be provided for alignment of the earth path to the view indicated on the periscope. Control knobs shall be provided for ORBIT-E.W., POLAR-E.W., ORBIT TIME, WIND, and INCLINATION DEGREES. The INCLINATION DEGREES knob shall include radially arranged numbers and shall be located adjacent to the earth position index. Latitude and longitude lines shall be spaced in 15-degree increments as required for map compatibility (see Paragraph 3.16.2.1). Indicator glass shall be a nonreflective type.

3.8.9.6 SWITCHES AND HANDLES - The following switches and handles with their respective positions and functions shall be located on the instrument panel, left-hand console, and right-hand console as indicated. This tabulation shall exclude sequence system override controls and warning light TONE-OFF switches as specified in Paragraphs 3.8.9.4 and 3.8.9.4.1.

Type	Positions	Function Controlled	Location
Toggle Switch*	Arm - Off	Squib	
Toggle Switch*	Arm - Off	Auto Retro Jett (P-9)	
Toggle Switch*	Norm - Fly-By-Wire - Aux - Damp	ASCS Mode Select (P-19)	
Toggle Switch*	Auto - Rate Comd.	ASCS Mode Select (P-26)	
Toggle Switch*	Gyro Norm - Gyro Cage - Free	ASCS Mode Select	
"T" Handle**	Pull to Dump - (Push to Close)	Decompress	Left-Hand Console
"T" Handle**	Pull to Repress - (Push to Reset)	Repressurize	
"T" Handle	Pull Direct - Push Rate Comd.	Manual Fuel Control	
"T" Handle	Pull Off - Push On	ASCS Roll Fuel	
"T" Handle	Pull Off - Push On	ASCS Yaw Fuel	
"T" Handle	Pull Off - Push On	ASCS Pitch Fuel	

* Channel guarded.

** These shall be positively retained in the normal position by wire retention clips.

3.8.9.6 SWITCHES AND HANDLES - (Continued)

Type	Positions	Function Controlled	Location
"L" Handle	Pull to Water - Seal Regulator (turn to lock)	Prevent Entry of Water through Cabin Relief Valve	
Toggle Switch	Norm - Inst	Retro Delay (P-23)	Left-Hand Console
Toggle Switch	Both - Off - L.H. Only	Cabin Lights	
Toggle Switch	On - Off	Low Freq. Telemetry	
Toggle Switch	On - Off	Photo Lights	
Toggle Switch	Light Test	Light Test	
Toggle Switch	Auto - Man On	Rate Indicator	
Push Button (with plastic cover)	Press	Time Zero (P-24)	
Toggle Switch	Standby - Off - Norm.	Fans AC Bus	
Toggle Switch	Emerg - Norm	Audio Bus	Main Instrument Panel
Toggle Switch (with plastic Guard)	Bypass - Norm - Pwr. Off	Ammeter	
Rotary Switch	250VA - 150VA - Stby - ASCS-Fans	AC Volts	
Toggle Switch	No. 2 - Norm - No. 1	Suit Fan	
Toggle Switch	Off - Norm	Cabin Fan	
Toggle Switch	On - Off	Standby Battery	
Toggle Switch	Standby - Norm	Isolated Battery	
Toggle Switch	Standby - Off - Norm	ASCS AC Bus	

3.8.9.6 SWITCHES AND HANDLES - (Continued)

Type	Positions	Function Controlled	Location
Toggle Switch	Dim - Bright	Warning Lights	Main Instrument Panel
Toggle Switch*	R/T - Norm	UHF DF (P-21)	
Toggle Switch (with Hood Guard)	Bypass - Norm	Inlet Valve Power	
Toggle Switch*	Lo Pwr - Hi Pwr	UHF Select (P-22)	
Toggle Switch*	Grnd Comd - Cont.	Beacon	
Toggle Switch*	HF - UHF - Off	Transmit	
Rotary Switch		Voltmeter Selection	
Push Button	Start	Blood Pressure	
Push Button	Stop	Blood Pressure	
Toggle Switch	Off - On	VOX Pwr.	
Toggle Switch	Sec - Prim	O_2 Flow	
Knob	Hot - Normal - Cold	Suit Temperature	Right-Hand Console
Knob	Hot - Normal - Cold	Cabin Temperature	
Handle	Emerg - Norm	Emergency O_2	

3.8.9.7 FUSE SWITCHES - Fuse switches shall be provided for manual reset of interrupted circuits, but actuation by the astronaut shall be based upon his knowledge of the capsule systems and their functions. No special visual systems for indication of an interrupted circuit shall be

* Channel Guarded Switches

3.8.9.7 FUSE SWITCHES - (Continued)

provided. Fuse switches shall be located on the main instrument panel and on a switch panel in accordance with Drawing No. 45-81014 located to the astronaut's left, adjacent to the outer panel of the left-hand console. A solid conductor shall be installed in one position of each switch in critical circuits (indicated below by *) to prevent complete loss of any of these circuits due to a blown fuse.

The following fuse switches shall be located on the extreme right of the main instrument panel:

Suit Fan	Envir. Contl
Retro Jett*	Retro Man*
Programmer	Blood Press.

The following fuse switches shall be located on the switch panel:

Spare	No. 1 Retro Rckt	Emer Main Deploy*
Emer Cap Sep Contl*	No. 2 Retro Rckt	Reserve Deploy*
Emer Escape Rckt	No. 3 Retro Rckt	Emer Reserve Deploy*
Tower Sep Contl*	Emer Retro Seq	Emer Land Bag
Emer Tower Sep	Emer Retro Jett	Emer Rescue Aids
Emer Tower Jett	ASCS .05G	Periscope
Emer Posgrd	Emer .05G	Ant Switch
Aux BCN	Emer Drogue Deploy	Comd Rcvr A
	TLM - Hi Freq.	

* Contains one solid conductor.

3.8.10 LIGHTING - Lighting for the cabin instruments and cameras shall be a dual AC system utilizing floodlights located in the pressurized area. The lights, in accordance with Drawing No. 45-79738, shall consist of four white, six-inch fluorescent tubes, each providing 4 watts illumination. One set of lights shall be located to the right and left of the astronaut, one to a side. Each of these lights shall incorporate a dimmer slide to permit variation in light intensity. The slides shall conform to the curvature of the lights and shall contain tabs to permit actuation by the astronaut. The slides shall be maintained in any position by friction and shall be operable through any selected light intensity from bright to full dark. For night-day adaptability, each of these light assemblies shall have a red filter slide mounted in the inner track of the slide assemblies. The filter slides shall contain tabs to permit actuation by the astronaut and shall be operable either with or independent of the dimmer slides. The filter shall be positioned either in the full "on" or full "off" position and shall remain positioned by friction. One set of lights of fixed intensity shall be located to the astronaut's right and left, above and behind his head, for instrument panel photographing. These lights may be controlled by actuation of the PHOTO LIGHTS switch located on the left-hand console.

INSTRUMENT PANEL AND CONSOLES

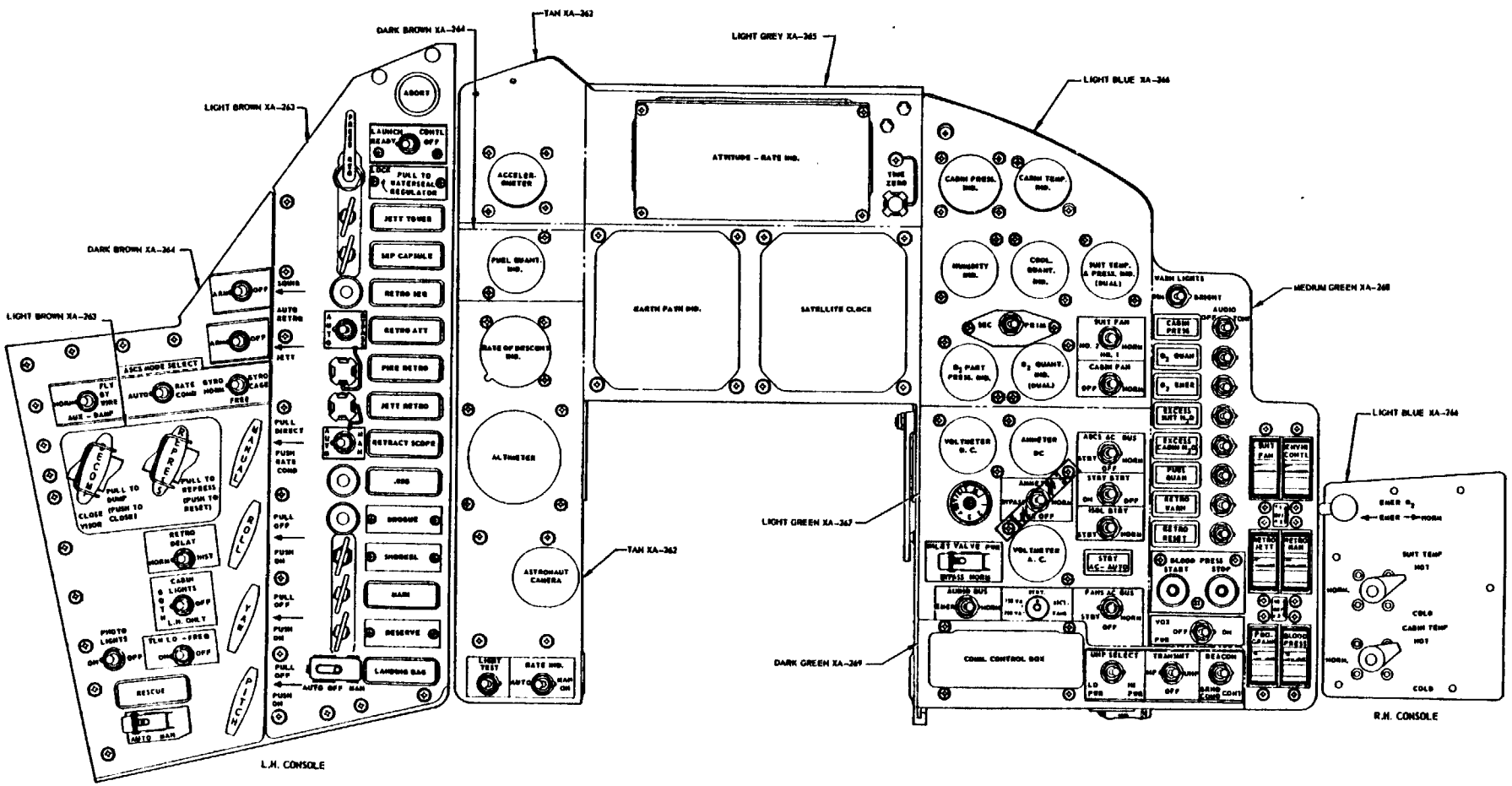


FIGURE 3

THREE AXIS HAND CONTROLLER

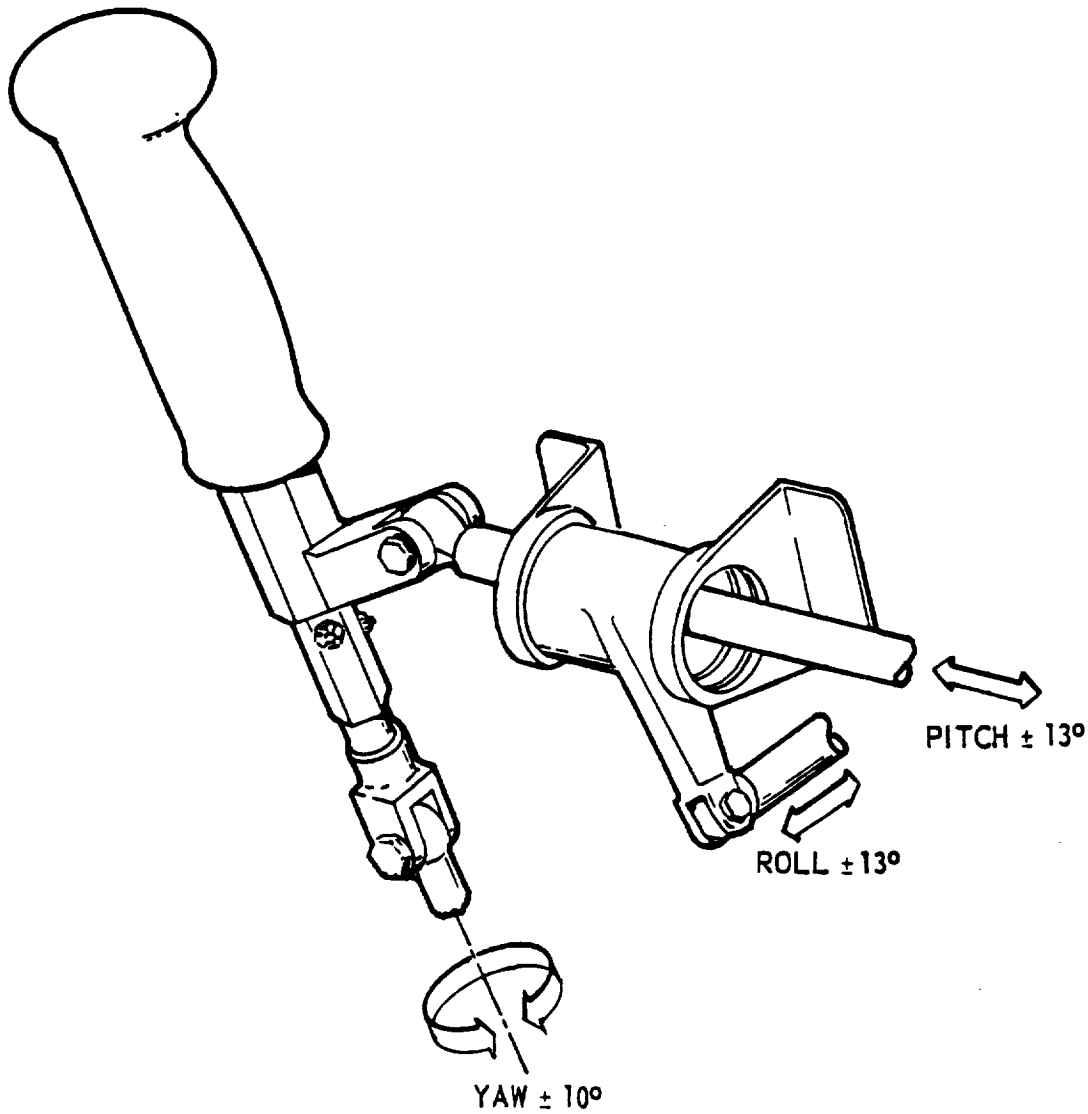


FIGURE 4

3.9 CAPSULE ENVIRONMENTAL CONTROL

3.9.1 ENVIRONMENTAL CONTROL SYSTEM - A capsule environmental control system shall be provided to successfully complete the mission as stated in Paragraph 1.1.1. The environmental control system, in accordance with Drawing No. 45-83700 (see Appendix I-C, Item 8, herein), shall provide the following:

a. Environmental control, pressure suit (internal circuit)

b. Environmental control, cabin and equipment

c. Cabin pressure relief

d. Post-landing ventilation

e. Cooling, prelaunch

3.9.1.1 DESCRIPTION - The environmental control system shall consist of a gaseous oxygen supply that shall furnish breathing, ventilation, and pressurization gas for the pressure suit and cabin. The environmental control system shall be designed to automatically control the environmental conditions within the pressure suit and cabin during all phases of the mission as described in Paragraph 1.1.1 herein. Separate evaporative heat exchangers shall cool the suit circuit and cabin. Oxygen flowing from the suit circuit compressor shall pass through the carbon dioxide (CO_2) and odor absorber, which shall be divided into individual sections that shall contain a supply of activated charcoal and lithium hydroxide (LiOH). The activated charcoal shall remove odor and the LiOH shall remove the CO_2 from the gas flow. Filters shall be incorporated in the absorber to filter any charcoal or LiOH dust from the gas flow. An O_2 partial pressure sensing system shall transmit a signal proportional to the amount of O_2 partial pressure in the suit circuit to the indicator provided on the main instrument panel.

Moisture condensed in the pressure suit heat exchanger shall be absorbed and retained in a vinyl sponge. At timed intervals, the sponge shall be automatically compressed to force the condensate from the sponge to a condensate tank for storage. The sponge shall be compressed by a piston actuated by oxygen pressure. Gas flow from the pressure suit passes through a solids trap which shall remove any foreign matter, such as food particles, hair, nasal excretion, etc., from the suit circuit gas supply. The solids

3.9.1.1 DESCRIPTION - (Continued)

trap shall incorporate a relief feature to prevent the possibility of foreign matter blocking suit circuit flow. During re-entry at approximately 17,000 feet, ambient air shall be directed into the cabin for cooling and ventilating. The equipment shall be as simple and passive in operation as practicable and shall provide the following:

a. Metabolic oxygen, pressurization and ventilation in the pressure suit and cabin.

b. Pressure suit ventilation for twelve hours of the post-landing phase.

c. A selectable cabin temperature between 50 degrees F. and 80 degrees F. during orbit.

d. Comfortable humidity-temperature level within the pressure suit during all phases of flight.

e. Carbon dioxide, moisture, odor and solid particles removal.

f. Suit and cabin pressure regulation during all phases of flight.

g. A decompression feature for fire extinguishing.

h. Satisfactory operation in a weightless or high "g" environment.

i. A secondary oxygen supply.

3.9.1.2 OPERATIONAL SEQUENCE

3.9.1.2.1 PRELAUNCH - During capsule prelaunch operation, the suit circuit (with facepiece closed) and cabin shall be purged with oxygen from an external low pressure source. Freon 114 refrigerant shall be introduced into the pressure suit and cabin heat exchangers from an external source through the capsule umbilical connection to provide cooling for the suit and cabin. Cabin and suit temperatures shall be controlled by the ground crew by regulation of the Freon 114 flow to the heat exchangers. Prior to launch, the internal oxygen supply shall be activated by a ground crewman who shall at the same time disconnect the external oxygen supply. Breathing gas from the internal O_2 supply shall be used by the astronaut during the count-down period. The Freon 114 refrigerant line shall be disconnected at capsule umbilical separation. A leakage check of the hatch seal shall be made by pressurizing the cabin to 19.7 PSIA via an external source through the cabin pressurization fitting assembly.

3.9.1.2.2 LAUNCH - During the launch operation, the cabin pressure relief valve will prevent the cabin-to-ambient differential pressure (Δp) from exceeding 5.5 PSIG and shall maintain a cabin-to-ambient differential pressure (Δp) of approximately 5.5 PSIG thereafter.

3.9.1.2.3 ORBITAL - The internal cabin temperatures during the orbital phase shall be dependent on the following:

a. Direct solar radiation absorbed at the outer surface of the vehicle.

b. Solar radiation reflected from the earth to the vehicle.

c. Direct radiation emitted from the earth to the vehicle.

d. Radiation emitted from the vehicle to the earth and space.

e. Internal heat generation from the astronaut and equipment.

f. Mass of the structure, insulation, equipment and furnishings.

Cabin temperature shall be regulated by adjustment of the cabin temperature valve. Cabin air shall be circulated by the cabin equipment fan which shall force the cabin gas through the equipment heat exchanger and around the electronic equipment. After discharge from the electronic equipment, the gas shall circulate within the cabin. In the event of cabin decompression to 4 PSIA ($\pm$.2) or below, power to the cabin equipment fan shall be automatically interrupted until such time as the cabin is repressurized to approximately 4.6 PSIA. Pressurization of the cabin shall be achieved by oxygen flow through the dual cabin pressure control valve. Pressure relief shall be afforded by the cabin pressure relief and emergency decompression valve.

Oxygen shall be admitted from the primary oxygen bottle through pressure reducing valves which shall drop the pressure from 7500 PSIG to 100 PSIG. The internal circuit pressure regulator shall supply the oxygen necessary to maintain approximately a 5 PSIA level during the orbital period. During ascent and descent, the suit pressure regulator shall also equalize suit internal and external pressure. A separate secondary bottle in parallel with the primary bottle shall admit oxygen to the system through an oxygen pressure reducer which shall drop the pressure from 7500 PSIG to 80 PSIG. The cabin and suit circuits shall constitute redundant breathing and pressure sources, permitting the facepiece to be open or closed as desired by the astronaut.

3.9.1.2.3 ORBITAL - (Continued)

The suit circuit compressor shall force gas through the pressure suit, solids trap, carbon dioxide and odor absorber, heat exchanger and water absorber. Pressure within the suit shall be maintained at 5 PSIA.

In the event of failure of the main suit compressor, a back-up compressor shall be actuated automatically by the compressor differential pressure sensor. Should both compressors fail, the astronaut may breathe cabin atmosphere or utilize the emergency oxygen flow rate mode. (See Paragraph 3.9.1.3.c). In event of a meteoric collision causing depressurization of the cabin, the astronaut shall be able to continue by using the suit circuit for the full mission time at the normal oxygen usage rate or for one orbital cycle at the emergency flow rate of approximately 0.05 lb./min. In event of fire or build up of toxic contaminants, the cabin may be decompressed.

3.9.1.2.4 RE-ENTRY - During re-entry, the environmental control system shall function as in the orbital sequence. Prior to re-entry initiation, cabin and cabin contents shall be cooled to as low a value as possible. Suit and cabin pressures shall remain at approximately 5 PSIA until an altitude of 25,000 feet is reached. At 17,000 feet, external air shall be automatically circulated through the suit circuit. In an emergency, a re-entry following a double failure of the recirculation system (with or without cabin depressurization) shall be accomplished using the emergency oxygen rate to provide breathing, ventilation and pressurization of the suit. A reflective coating on the outer surface of the pressure suit will reduce radiant heat input.

3.9.1.2.5 POST-LANDING - Operational provisions shall be incorporated in the suit circuit for a 12 hour post-orbital period. Ambient air shall be drawn into the suit circuit through a snorkel fitting, circulated and exhausted overboard through a snorkel outlet.

3.9.1.3 OPERATIONAL MODES - The environmental control system shall operate automatically or manually in the following modes:

a. CABIN MODE - In this mode of operation the astronaut may have his suit face plate open to the cabin environment. The cabin temperature shall be selected by the astronaut, by actuation of the knob located on the right-hand console (see Paragraph 3.8.9.6).

b. SUIT MODE - In this mode the astronaut will have his suit face plate closed and the cabin atmosphere will be excluded.

3.9.1.3 OPERATION MODES - (Continued)

The CO_2 content of the suit gas supply shall be maintained below 8mm Hg. Comfortable combinations of temperature and humidity shall be selectable. Dual compressors shall be provided in the suit circuit, and the stand-by compressor shall be automatically switched on if the primary compressor fails. The astronaut also shall be able to switch in the stand-by compressor. (See Paragraph 3.8.9.6). If the suit circuit fails, the emergency mode can be used. If the cabin system is operating normally when the suit circuit fails, the astronaut may open the face plate instead of actuating the emergency mode.

c. EMERGENCY MODE - In this mode of operation an automatic and/or manual emergency oxygen rate capability shall be provided. The emergency oxygen rate may be used during loss of cabin pressurization or during failure of the closed environmental control system. This oxygen shall be available for use in the suit mode (b) described above. This system shall be used through the suit by a direct open oxygen system in which expired oxygen is discharged by being dumped into the cabin and then overboard. Provision shall be made to permit the use of remaining primary oxygen supply for this mode; however, special provision shall be made to prevent loss of oxygen to the cabin system if the cabin system fails.

3.9.1.4 ENVIRONMENTAL CONTROL SYSTEM WARNING INDICATION - Amber warning lights (with accompanying audio tones) shall be provided on the warning light portion of the main instrument panel (see Paragraph 3.8.9.4.1) for indication of the following:

CABIN PRESSURE (Loss of cabin pressure below 4 PSI)

O_2 QUANTITY (Depletion of Primary O_2 Supply)*

O_2 EMERGENCY (O_2 flow)

EXCESS SUIT H_2O (Low temperature in heat exchanger exhaust)

EXCESS CABIN H_2O (Low temperature in heat exchanger exhaust)

* With O_2 FLOW switch (see Paragraph 3.8.9.6) in PRIM position. Secondary O_2 flow may be monitored by placing this switch in SEC position.

3.10 STABILIZATION CONTROL SUBSYSTEM - The stabilization control subsystem shall consist of the automatic stabilization and control system, the rate stabilization and control system, the horizon scanners, and the reaction control system. The launch trajectory control and guidance shall be considered an integral part of the launching missile system and shall not be the responsibility of the capsule contractor.

3.10.1 AUTOMATIC STABILIZATION AND CONTROL SYSTEM - The automatic stabilization and control system (ASCS) as defined in Drawing No. 45-87700 (see Appendix I-C, Item 5, herein) shall provide automatic stabilization and orientation of the capsule from time of separation from the booster-adapter until landing parachute deployment in accordance with the various phases of the mission. The ASCS shall supply output signals for display, recording and telemetering of three-axis attitude information, a discrete signal at 0.05g longitudinal acceleration during re-entry, and attitude signal sectors for use in the capsule retrograde firing interlock circuit. Associated equipment consisting of the horizon scanners, reaction controls, communications system telemetry, devices for display of the capsule attitude, and devices for generating capsule signals for discrete mission events, shall be utilized by the ASCS. The expenditure of propellant shall be minimized by the design of the control system.

3.10.1.1 MODES OF OPERATION - The ASCS shall have four modes of automatic operation. These shall be damper mode, orientation mode, attitude-hold mode, and re-entry mode. In addition, the ASCS shall include switching to allow alternate manual "fly-by-wire" and auxiliary damping modes. In the "fly-by-wire" mode, the automatic reaction control nozzles shall be controllable by the astronaut through limit switches actuated by stick controller motion. The auxiliary damping mode shall provide rate damping only and shall disengage the automatic and "fly-by-wire" functions. Other than override controls, no provisions shall be made for manual stepping of the ASCS automatic sequencing.

3.10.1.2 SEQUENCE OF OPERATION - The following general sequence of operation compatible with capsule sequence shall be provided by the ASCS.

a. Rate damping in early abort cases.

b. Rate damping, turn-around, and capsule orientation to the orbit attitude of 34° (blunt end up) in later aborts or after capsule-adapter separation in normal orbital missions.

c. Orientation during orbital flight through retrograde rocket firing as follows:

3.10.1.2 SEQUENCE OF OPERATION - (Continued)

1. Orientation with respect to the local earth vertical (such that the astronaut's head would be up).

2. Provide required capsule orientation prior to the retrograde rocket firing.

3. Hold prescribed 34° (± 5°) retrograde pitch attitude during retrograde rocket firing.

d. Switching to re-entry mode at retrograde assembly jettison, providing capsule orientation to a prescribed re-entry pitch attitude of 1.5° (± 5°) following retrograde rocket firing.

e. Hold 1.5° (± 5°) re-entry pitch attitude until 0.05g acceleration is sensed.

f. Switching to rate damper mode at longitudinal acceleration (from drag buildup) of 0.05g and providing a steady roll of approximately 10-12 degrees per second thereafter until disengagement.

g. Disengagement when landing chute deploys.

The ASCS shall include, in addition to amplifier-calibrator (computing) equipment, pitch, roll, and yaw rate gyros, vertical and directional attitude gyros, and a longitudinal accelerometer. The rate gyros shall sense capsule rotational rates, and the longitudinal accelerometer shall sense 0.05g longitudinal acceleration for initiation of the re-entry mode. The attitude gyros with signal inputs from the horizon scanners and slaving computation performed in the amp-cal, shall sense pitch, roll and yaw attitudes for an attitude reference system. The pitch and roll outputs of the horizon scanners shall be utilized to precess the gyros such that their spin axes shall be maintained in the properly erected position relative to the moving local vertical axis. Prior to launch, both the vertical and directional gyros shall be torqued so as to erect their spin axes to any desired orientation relative to the launch trajectory. During the climb phase of the mission after tower separation, the vertical gyro spin axis shall be erected to the horizon scanners. After tower separation the vertical and directional gyros and the horizon scanner shall function as shown in Figure 6. At 0.05g, the horizon scanners shall be de-energized and the capsule pitch and yaw angular rates shall be maintained at a value which will impose tolerable acceleration levels on the astronaut and equipment. At the same time, a steady state roll rate of approximately 10 to 12 degrees per second shall be established and maintained until disengagement of the ASCS at main landing parachute deployment.

3.10.1.3 RATE STABILIZATION AND CONTROL SYSTEM - A rate stabilization and control system shall be provided. This system, which shall operate independently of the ASCS except for sensing of 0.05g, shall provide a redundant rate damping feature that shall back up ASCS rate damping if necessary, and also provide the astronaut with a control stick steering mode. Movement of the three-axis hand controller shall provide capsule angular rates approximately proportional and corresponding to stick deflection. The rate stabilization and control system shall include a rate damper, three control stick position potentiometers, fuel subsystem, six solenoid control valves and a fuel selector valve to the manual reaction control subsystem, pitch, roll and yaw rate transducers, plus necessary mode select switch, connectors and wiring. Use of the rate stabilization and control system in event of ASCS malfunction shall provide a constant roll rate capability after 0.05g sensing. An automatic constant seven (7) degree per second (± 2 degrees per second) roll rate shall be initiated by closure of the ASCS 0.05g acceleration switch. Pitch and yaw rates shall be damped to zero degrees per second (± 3 degrees per second) by the RSCS when in the "Rate Command" mode. This shall provide stabilization during the re-entry trajectory without requiring hand controller manipulation by the astronaut.

3.10.1.3.1 OPERATION - The rate stabilization and control system shall be activated by the astronaut by selection of the RATE COMMAND position of the AUTO-RATE COMMAND mode select switch and by depression of the manual fuel control handle to permit hydrogen peroxide flow from the selector valve to the solenoid valves. Upon selection of the "Rate Command" mode, power shall be applied to the rate damper electronics. The rate damper shall receive rate feedback information from the rate transducers and rate command signals from the control stick potentiometers located on the hand controller linkage. These inputs shall be summed by the rate damper summing preamplifier-demodulator, where angular rates must exceed a deadband zone of plus or minus two (± 2) degrees per second in the roll axis and plus or minus three (± 3) degrees per second in the pitch and yaw axes, before the output signal can be transmitted to torque switching logic relays. Upon receipt of a signal for corrective positive and negative commands, the appropriate logic relay shall energize the positive or negative solenoid valve and initiate corresponding thrust chamber reaction.

3.10.2 HORIZON SCANNER SYSTEM - A horizon scanner system in accordance with Drawing No. 45-87702 shall be provided for sensing roll and pitch attitude reference for the ASCS. The horizon scanner system shall consist of two scanner units, one unit aligned to the capsule pitch axis and one unit aligned to the capsule roll axis. The scanner assemblies shall be mounted on the structure within the antenna fairing assembly, and shall provide a 118 degree conical scan of the horizon through a rotating prism located ahead of the scanner lens. The prism shall rotate at a speed of approximately 30 revolutions per second. Each scanner unit shall receive AC power inputs

3.10.2 HORIZON SCANNER SYSTEM - (Continued)

through the capsule AC power system and shall supply DC output signals of the required polarity to provide roll and/or pitch signals up to a maximum of 35 degrees for torquing the attitude gyros in the ASCS. Yaw sensing shall be achieved through torquing of vertical and directional gyros of the ASCS by horizon scanner roll signal inputs. Pitch and roll sensing shall possess sufficient accuracy to enable the astronaut to orient the capsule within $\pm 5^{\circ}$ of the orbital attitude. The scanners shall be energized at time-zero and shall function as indicated in the sequential schematic, Figure 6, Page 76.

Individual thermostatically controlled blanket heaters in accordance with Drawing No. 45-78071 shall be provided for each horizon scanner to maintain the required scanner operating temperature. These heaters shall be energized when power is applied to the 24 volt DC bus and shall function continuously through antenna assembly jettison.

A protective fiberglas cover assembly in accordance with Drawing No. 45-31064 shall be provided for the roll scanner. The cover shall protect the scanner glass from blast erosion from the escape rockets, and shall be automatically erected to permit horizon scanning at tower jettison + 4 seconds (see Paragraph 3.5.6).

3.10.3 REACTION CONTROL SYSTEM - The reaction control system in accordance with Drawing No. 45-61700 (see Appendix I-C, Item 6, herein), shall consist of an automatic control subsystem and a manual control subsystem, as depicted in Figure 5, Page 64 herein. The reaction control system shall provide control of the capsule in the roll, pitch and yaw axes. This system shall be a pressure-fed, monopropellant/catalyst bed design, incorporating right angle firing exhaust nozzles which shall produce thrust through decomposition of hydrogen peroxide (H_2O_2). Minimal translational motions may result upon application of reaction control thrust.

3.10.3.1 AUTOMATIC CONTROL SUBSYSTEM - The automatic control subsystem shall basically consist of a helium (He) sphere, pressure regulator, hydrogen peroxide (H_2O_2) propellant tank, and twelve thrust chamber assemblies. Each thrust chamber assembly shall consist of a solenoid valve, heat barrier and thrust chamber. The fuel supply shall be unstabilized hydrogen peroxide contained inside a flexible bladder which in turn shall be contained in a half toroidal tank. This system shall function automatically in conjunction with the automatic stabilization and control system. The high pressure helium transducer shall provide a means of monitoring (by proper calibration) the percentage of H_2O_2 present in the bladder. Sufficient H_2O_2 and helium shall be provided to maintain damper operation until after main parachute deployment, at which time the H_2O_2 is jettisoned.

3.10.3.2 MANUAL CONTROL SYSTEM - The manual control subsystem shall consist of a pressurization system, a fuel distribution system and six thrust chamber assemblies. The yaw, pitch, and roll control each consists of one pair of thrust chamber assemblies with a single proportional control propellant valve. The helium portion of the manual control subsystem shall be identical to the corresponding portion of the automatic subsystem. The manual subsystem shall have a smaller capacity for H_2O_2 than the automatic subsystem. The manual control subsystem shall include a two-way vented selector valve to provide selection of proportional torque control through three proportional valves, or rate control (via RSCS) through six solenoid valves. The latter solenoids shall receive positive and negative torque command signals from the RSCS rate damper. The manual subsystem shall be controlled by the astronaut by means of the 3-axis hand controller (see Paragraph 3.8.8.2.1), and shall be capable of overcoming the disturbance torque resulting from firing the retrograde rockets. Sufficient H_2O_2 and helium shall be provided to maintain damper operation until after main parachute deployment, at which time the H_2O_2 shall be jettisoned.

3.10.3.3 OPERATION - High pressure helium shall be utilized to pressurize the H_2O_2 torus propellant tanks. The high pressure (2250 PSIG) helium gas shall pass through a filter and manual shutoff valve to a pressure regulator which shall reduce the pressure to 480 PSIG, through a check valve, and finally surround and pressure the flexible bladder of the torus tank. The helium pressure shall force the H_2O_2 out of the bladder through the perforated tube downstream into the lines and valves. The manual push-pull shutoff valves, which allow the H_2O_2 to be available at the solenoid valves, shall provide a means of individual system isolation and shutoff. The shutoff valves shall be vented overboard through a line system in accordance with Drawing No. 45-62075 to reduce the possibility of fire due to H_2O_2 leakage. Upon receiving a 24 volt DC signal from the ASCS, the appropriate solenoid valve shall open. Hydrogen peroxide shall then pass into the corresponding thrust chamber where it shall be decomposed providing the following thrust levels for operation with the ASCS:

a. High thrust level of twenty-four pounds for pitch and yaw axes and six pounds for the roll axis.

b. Low thrust level of one pound for all three axes.

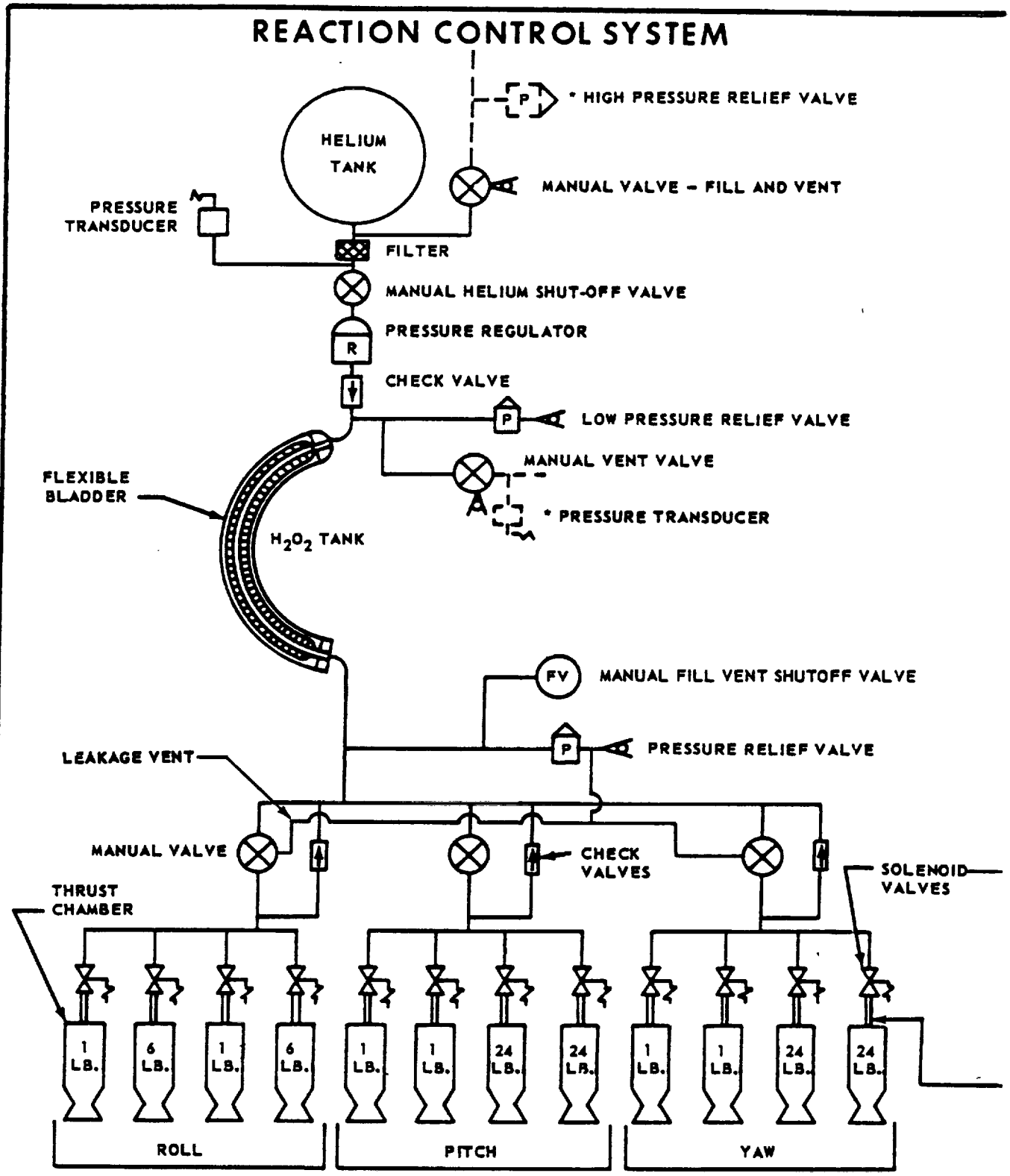
These thrust levels shall be available in discrete, short-time periods as controlled by the ASCS.

The helium pressure transducer shall provide a means of monitoring the percentage of H_2O_2 present in the bladder. The internal transfer tube shall guarantee uninterrupted and total fuel flow. The external transfer tube shall assure that no helium shall be trapped during propellant filling.

3.10.3.3 OPERATION - (Continued)

The manual control subsystem shall provide proportional control or rate control (via RSCS) and thrust levels between four and twenty-four pounds for pitch and yaw axes and between one and six pounds for roll axis. These thrust outputs shall be controlled from the hand controller through direct stick control. Thrust outputs controlled through the rate stabilization and control system electronics shall provide a thrust level of twenty-four pounds for pitch and yaw axes and six pounds for the roll axis.

3.10.3.4 TANKS - The helium tanks for each system shall be located in the cabin and shall be of spherical fiberglas construction. These tanks shall store the helium at 2250 PSIG and pressure feed to the H_2O_2 tank at 480 PSIG. The H_2O_2 tanks shall be a half-toroidal configuration contoured to mount on the aft pressure bulkhead between the bulkhead and the heat shield. The H_2O_2 tanks shall be constructed of aluminum, insulated to provide temperature control, and incorporate a flexible plastic bladder to provide pressure for positive expulsion of the H_2O_2. Provisions for in-flight jettisoning of H_2O_2 after main parachute deployment shall be provided.



AUTOMATIC SUBSYSTEM

FIGURE 5

3.11 RETROGRADE ROCKET SYSTEM

3.11.1 DESCRIPTION - The re-entry phase of the mission shall be initiated by firing a retrograde rocket system consisting of three Thiokol Model TE-316 solid-propellant rockets and associated components as specified in Appendix I-C, Item 2 herein. The target value for magnitude of the retrograde impulse shall be to provide a velocity decrement of approximately 465 feet per second for the capsule weight as specified in Paragraph 3.1.1.3. The rockets shall have a total vacuum impulse of approximately 12,960 pound-seconds providing an average thrust of 968 pounds each for 13.39 seconds action time under the conditions specified in Drawing No. 45-50700.

3.11.2 INSTALLATION - The retrograde rocket assembly shall be mounted on a structural frame encased within an insulated aluminum alloy housing which shall be secured external to the heat shield by retaining straps. The retaining straps, per Drawing No. 45-72030, shall be attached to the capsule by retention fittings, per Drawing No. 45-32086, which remain engaged only as long as tension exists in the straps, and to the rocket structural assembly by a centrally located explosive bolt, in accordance with Drawing No. 45-72704. For capsule shipment, an inert bolt shall be provided, but prior to capsule launching, a "live" explosive bolt shall be installed. Jettison of the retrograde rocket assembly shall be effected by release of the retaining straps by firing the explosive ejector bolt, removing tension from the retaining straps, and permitting a compression spring jettison assembly, per Drawing No. 45-50013, to thrust the retrograde assembly from the capsule. Initiation of the ejector bolt shall be through a firing-command latching signal which shall permit retrograde rocket assembly separation after a 60-second time delay. The rockets and rocket nozzles shall be shielded by cover assemblies, per Drawing No. 45-50012, for protection against meteorite penetration. These covers shall blow off as the rockets fire. The rocket assembly housing shall be finished with a paint possessing sufficient solar absorptivity characteristics to provide a relatively warm environment within the enclosure. Provision shall be made within the housing in each rocket installation, to insure proper temperature control by inclusion of a heater assembly, Drawing No. 45-50702, and by blanket insulation. Rocket thrust direction shall be aligned on the ground prior to launch so as to minimize eccentricity between the thrust vector and the capsule center of gravity.

3.11.3 IGNITION - Automatic sequencing of the retrograde operation may be initiated by a signal from any one of three sources: signal from the satellite clock, a ground command signal via the command receivers and decoders (see Paragraph 3.14.2); or, manually by astronaut override by actuation of the push button (P-6) adjacent to the RETRO SEQ. telelight. The initiating signal shall simultaneously energize a 30-second time delay relay, initiate the re-entry mode of telemetry and instrumentation, and command the ASCS to discontinue pulse-type control and assume the retrograde mode of

3.11.3 IGNITION - (Continued)

control torque switching. ASCS electronics shall sense an attitude within "permission" bounds of ± 30° yaw, ± 30° roll, and 34° ± 12.5° pitch, and energize the retrograde interlock relay in the ASCS calibrator. Closure of this relay shall energize "attitude permission" relays which shall, upon runout of the 30-second time delay relay, complete the circuit and initiate a signal to the retrograde rocket firing circuits to sequentially fire the rockets at 5-second intervals. Retrograde firing shall be sensed by limit switches installed beneath the retrograde rocket covers. As the covers are jettisoned by rocket firing, the switches shall be released, closing circuitry which shall initiate telemetry, onboard recording, and telelight indication that one or more of the retrograde rockets has fired. This signal shall also be applied to a 4- and 8-minute time delay relay which upon runout shall transmit a signal to the ground via telemetry for indication of retrograde rocket firing. Determination of firing time can be made by subtraction of 4 or 8 minutes from the time of ground signal receipt. At the same time as the rocket firing signal is initiated, the ASCS "attitude permission" switch shall energize a 23-second time delay relay which shall apply a "retrograde fire" signal to the ASCS for 23 seconds. Jettison of the retrograde assembly shall be as described in Paragraph 3.11.2.

3.11.4 POSIGRADE ROCKET SYSTEM - Separation of the capsule from the adapter-booster vehicle shall be aided by firing a posigrade rocket system provided in accordance with Drawing No. 45-50001 and consisting of three Atlantic Research Corporation solid-propellant rockets as specified in Appendix I-C herein. These rockets shall have a total impulse of 475 pound-seconds each, providing an average thrust of 370 pounds each for an action time of 1.35 seconds, under the conditions specified in Drawing No. 45-50701. Firing the posigrade rockets shall produce a separation velocity of 28 feet per second. The posigrade rockets shall be symmetrically mounted in the retrograde rocket assembly housing between the retrograde rockets. Posigrade rocket system initiation shall be accomplished automatically through a separation signal from the capsule-adapter ring separation sensor after firing of the capsule-adapter clamp ring explosive bolts.

3.12 ESCAPE SYSTEM - An active escape system shall be provided as an integral part of the capsule. The escape system shall provide positive capsule-sustainer separation characteristics and adequate launch aerodynamic heating protection for the capsule afterbody. This system shall be capable of functioning during various periods up to tower separation should it become necessary to abort a mission and escape from the vicinity of the Atlas missile system. Escape sequence prior to and after release of the active escape system for either a normal or aborted mission shall be as specified in Paragraph 3.12.5.

3.12.1 DESCRIPTION - The escape system shall include a pylon framework assembly in accordance with Drawing No. 45-31001, which shall support an escape rocket installation in accordance with Drawing No. 45-51001. The escape rocket installation shall consist of a structural assembly in accordance with Drawing No. 45-51002, an escape rocket in accordance with Drawing No. 45-51700, a pylon jettison rocket in accordance with Drawing No. 45-51701, an aerodynamic spike in accordance with Drawing No. 45-51017, and a ballast assembly in accordance with Drawing No. 45-51010. The pylon assembly shall be a tower structure consisting of three longitudinal members of tubular steel construction diagonally braced and shall incorporate an antenna cover assembly for shielding the antenna assembly. (See Paragraph 3.5.7.) The pylon shall be attached to the capsule cylindrical recovery compartment by a clamp ring assembly. A 45° aerodynamic fairing in accordance with Drawing No. 45-72045 shall be installed on the pylon clamp ring to facilitate greater aerodynamic stability of the capsule up to tower separation. The clamp ring assembly, in accordance with Drawing No. 45-72040, shall consist of three segmented sections joined by explosive bolts in accordance with Drawing No. 45-72702. Two of the explosive bolts shall be initiated electrically from either end by a dual electrical system. The third bolt shall be electrically initiated at one end and by a gas generated source at the other end through a percussion system. Initiation of the clamp ring separation explosive bolts shall be as described in Paragraph 3.12.5.

3.12.2 ESCAPE ROCKET - The escape rocket, in accordance with Drawing No. 45-51700, shall be supported by the pylon structure and the aerodynamic spike and ballast assembly shall be secured to the escape rocket structural assembly. The escape rocket shall consist of a solid-propellant rocket motor, with three nozzles canted nineteen degrees from the longitudinal axis of the rocket case, and an electrically actuated igniter. The nominal action time for the escape rocket shall be 1.39 seconds with an average resultant thrust of 52,000 pounds at its center line. Nominal total impulse rating of this rocket shall be 56,500 pound-seconds, under conditions specified in Drawing No. 45-51700.

3.12.3 PYLON JETTISON ROCKET - The pylon jettison rocket in accordance with Drawing No. 45-51701, shall be supported by the escape rocket structural assembly. This rocket shall be mounted on the escape rocket longitudinal axis among the canted nozzles. The pylon jettison rocket shall consist of a solid propellant rocket motor with three nozzles, each canted so as to prevent impingement of the jet blast on the blast shield and an electrically actuated igniter. The nominal action time for this rocket shall be 1.67 seconds with a nominal average thrust of 642 pounds and total impulse of 994 pound-seconds, under conditions specified in Drawing No. 45-51701.

3.12.4 ESCAPE SYSTEM PERFORMANCE - The escape system, during an escape from the ground launching pad, shall propel the capsule to an altitude of approximately 2200 feet. Determination of the nominal escape rocket thrust eccentricity shall be the result of rational analysis which will attain a reasonable compromise between adequate capsule-booster separation distance and tolerable astronaut and structural lateral load factor characteristics. The analysis shall consider effects such as:

a. Capsule abort conditions as a result of booster malfunction.

b. Booster flight characteristics subsequent to capsule-adapter separation.

c. Capsule escape rocket thrust eccentricity tolerance.

The determination of booster flight conditions leading to the initiation of the abort maneuver and following capsule separation shall not be the responsibility of the capsule contractor.

3.12.5 ESCAPE SYSTEM SEQUENCE - Escape system sequence for normal or aborted missions shall be as specified in the following paragraphs.

3.12.5.1 NORMAL MISSION - Normal sequence for the mission defined in Paragraph 1.1.1 shall be as defined below. (See the Sequential Schematic, Figure 6, Page 76).

A. At booster lift-off (2 inches off the pad) the following shall occur:

1. The booster failure detection system shall be activated.

2. A time zero reference shall be established in the satellite clock, maximum altitude sensor, and recording equipment.

3. The correlation light (See Paragraph 3.15.1.1) shall be de-energized.

3.12.5.1 NORMAL MISSION - (Continued)

B. At booster engine cutoff, the following shall occur:

1. A booster engine separation signal shall energize a 20-second time delay relay.

2. Upon run-out of the 20-second time delay, this signal shall energize the tower bolts fire relays. Activation of these relays shall energize the tower ring separate interlock relay and the pylon clamp ring explosive bolts.

3. Initiation of the explosive bolts shall permit separation of the clamp ring segments.

4. Separation of the clamp ring segments shall actuate a sensor which shall transmit a firing signal through the previously energized tower ring interlock relay, firing the escape rocket. This signal shall also be transmitted to the thrust cutoff sensor 0.20g comparator through the normally-closed position of the tower separate abort interlock relay.

5. Firing of the escape rocket shall carry the tower from the path of the capsule and sustainer portion of the missile as they ascend in their trajectories to orbital insertion. As the tower separates from the capsule, the tower separation relay is de-energized, closing contacts which arm the landing sequence system and energize HF communications. In the event the escape rocket fails to fire, the signal which exists at the thrust cutoff sensor (see Item 4 above) shall energize a 1-second time delay relay when a thrust decay to 0.20g is sensed. Upon runout of this time delay, the signal shall initiate ignition of the tower jettison rocket, which then performs the function of the inoperative escape rocket.

C. At sustainer cutoff the following shall occur:

1. An accelerometer type thrust cutoff sensor shall sense sustainer thrust decay to 0.20g at which condition the thrust cutoff sensor shall transmit a firing signal to a 1-second time delay relay.

3.12.5.1 NORMAL MISSION - (Continued)

2. Runout of this time delay relay shall energize the capsule-adapter bolts fire relays. Activation of these relays shall energize the capsule ring separation interlock relay and the capsule-adapter clamp ring explosive bolts.

3. Initiation of the explosive bolts shall permit separation of the capsule-adapter clamp ring segments.

D. At capsule-adapter clamp ring separation, the following shall occur:

1. The adapter ring limit switch sensor shall be activated from the "not separated" to the "separated" position.

2. Activation of this sensor shall transmit a signal through the previously energized capsule ring separation interlock relay and the "separated" position of the tower separation sensor relay, firing the posigrade rockets.

3. Firing the posigrade rockets shall actuate the capsule-adapter separation limit switch sensor "separation" contacts.

4. The capsule-adapter separation sensor shall arm the satellite clock, energize a 60-second time delay relay which upon runout shall command the orbit mode of telemetry and instrumentation, and transmit a signal through a tower separation sensor power and control relay which shall energize the following:

a. A 5-second time delay relay and a power and control relay which shall command the damping mode of the ASCS until runout of the 5-second time delay relay at which time the orbit orientation mode shall be commanded.

b. A power and control relay which shall be held in the open position for 20 seconds by a time delay relay energized at tower separation. Upon runout of the 20-second time delay, the relay shall close, energizing another power and control relay which shall automatically extend the periscope.

3.12.5.1 NORMAL MISSION - (Continued)

E. At retrograde initiation, the following shall occur:

1. The satellite clock shall command the ASCS to assume the retrograde attitude, initiate the telemetry and instrumentation re-entry modes, energize a 30-second time delay relay and a 30-second by-pass switch in the event that it may be necessary for the astronaut to override the 30-second time delay relay.

2. Upon runout of the 30-second time delay relay, a signal shall be transmitted through the ASCS "attitude permission" relay (which is energized by an "attitude correct" signal from the ASCS) for firing the retrograde rockets.

3. At the same time as the retrograde firing signal is applied, a time delay relay shall be energized which shall apply a "retrograde fired" signal to the ASCS for a 23-second period. Firing and jettison of the retrograde rocket assembly shall be as specified in Paragraph 3.11.2. and 3.11.3.

F. At retrograde assembly jettison, the following shall occur:

1. The retrograde assembly separation limit switch sensor shall energize a 30-second time delay relay, which upon runout shall retract the periscope.

2. The retrograde attitude mode of the ASCS shall be switched to a re-entry orientation mode for acceleration less than 0.05g. A 5-second time delay relay shall be energized, which upon runout, shall arm the ASCS accelerometer for sensing capsule acceleration greater than 0.05g for re-entry stabilization, until drogue chute deployment. Landing system sequence shall be as described in Paragraph 3.17.1.

3.12.5.2 ABORTED MISSIONS - Mission aborts may occur either prior to staging or after staging as defined in the following paragraphs. Abort indication shall be provided by a red ABORT light on the left-hand console (see Paragraph 3.8.9.4.1). Abort indication shall also be telemetered to ground stations and tape recorded on board.

3.12.5.2.1 ABORT INITIATION - An abort shall be initiated by application of a 28-volt signal to the abort junction in the escape system electrical network. Upon receipt of a signal, the 28-volt source shall be instantly "locked in" at this junction and shall provide the necessary power source to initiate the abort sequence, consistent with the mode in which the abort maneuver is necessary. Mission aborts may be initiated under any of the following conditions:

a. Prior to capsule umbilical separation, an off-the-pad abort may be initiated from the blockhouse.

b. After capsule umbilical separation and prior to missile liftoff (2 inches altitude), an abort can be initiated by radio command, by hard-line which by-passes the missile lockout relay via the missile umbilical, or by the astronaut.

c. After missile liftoff, prior to missile umbilical separation, an abort can be initiated by radio command, by hard-line via missile umbilical, by the missile abort sensing and implementation system (ASIS), or by the astronaut.

d. After missile umbilical separation and prior to booster and/or sustainer cutoff, an abort can be initiated by radio command, the missile abort sensing and implementation system (ASIS), or by the astronaut.

e. After booster shutdown and tower jettison, but prior to sustainer cutoff, an abort can be initiated by radio command, the missile abort sensing and implementation system (ASIS) or by the astronaut.

f. After sustainer cutoff, an abort may be initiated by radio command or by the astronaut.

3.12.5.3 ABORT SEQUENCE OFF THE PAD AND PRIOR TO TOWER SEPARATION - Upon receipt of an abort command from sources a, b, c, or d as outlined in Paragraph 3.12.5.2.1, the following shall occur:

a. The capsule ABORT light shall be illuminated and the abort switches energized.

b. A shutdown command shall be transmitted to the booster (Stage 1) and sustainer (Stage 2) engine systems.

3.12.5.3 ABORT SEQUENCE OFF THE PAD AND PRIOR TO TOWER SEPARATION - (Continued)

c. A power and control relay shall transmit a signal to the capsule ring separation interlock relay and to capsule-adapter clamp ring explosive bolts through capsule-adapter bolts fire relays. Initiation of the explosive bolts shall permit separation of the clamp ring segments. This shall be detected by the adapter ring separation sensor which shall transmit a firing signal to the escape rocket. Firing of the escape rocket shall propel the capsule from the path of the booster vehicle.

d. Escape rocket firing shall be detected by the capsule-adapter separation sensor relays which shall:

1. Transmit an abort signal to a relay which shall initiate firing of the retrograde assembly explosive bolt for separation of the retrograde rocket assembly (see Paragraph 3.11.2). The retrograde assembly separation sensor shall energize a 5-second time delay relay which shall arm the ASCS accelerometer switch for sensing capsule conditions greater than 0.05g.

2. Provide an interlock for the input of the maximum altitude sensor (time versus time computer). The maximum altitude sensor in accordance with Drawing No. 45-87708 shall compute a time delay for abort tower separation versus real time beginning at time zero. This delay shall permit the capsule to reach a safe dynamic pressure before jettisoning the escape tower.

The time delay (ΔT) for tower separation with relation to time of abort (T_A) after time zero, shall be as follows:

ΔT, Sec. = $0.1855\ T_A + 7.0$ $\quad 0 \leq T_A \leq 62.0$

ΔT, Sec. = $1.6139\ T_A - 81.5630$ $\quad 62 \leq T_A \leq 81.62$

ΔT, Sec. = 50.165 $\quad T_A \geq 81.62$

The maximum altitude sensor shall initiate firing of the pylon clamp ring explosive bolts, permitting separation of the clamp ring segments.

3.12.5.3 ABORT SEQUENCE OFF THE PAD AND PRIOR TO TOWER SEPARATION - (Continued)

e. Simultaneously with the input to the maximum altitude sensor, the capsule-adapter separation sensor shall energize a power and control relay which shall close upon receipt of a tower separation signal and transmit an abort signal to the tower separation abort interlock relay which shall command the rate damping mode of the ASCS.

f. The pylon clamp ring shall separate, the tower ring separation sensor shall energize a power and control relay through the tower ring separate interlock relay, which upon receiving a signal from the tower separation abort interlock relay shall initiate firing of the pylon jettison rocket. Firing of the pylon jettison rocket shall actuate the tower separation sensor, which arms the landing sequence system (see Paragraph 3.17.1) and energizes HF communications.

3.12.5.4 ABORT SEQUENCE AFTER TOWER SEPARATION - Upon receipt of an abort command from sources e. or f. as outlined in Paragraph 3.12.5.2.1, the following shall occur:

a. The capsule ABORT light shall be illuminated and the abort switches energized.

b. The sustainer engine system (Stage 2) shall be shut down.

c. A power and control relay shall transmit a signal to a thrust cutoff sensor which shall sense sustainer engine thrust decay to 0.20g and energize a 1-second time delay relay. Runout of this relay shall energize the capsule ring separation interlock relay and the capsule adapter bolts fire relays. Activation of the latter relays shall fire the capsule-adapter clamp ring explosive bolts. Initiation of the explosive bolts shall permit separation of the clamp ring segments. This shall be detected by the adapter ring separation sensor which if tower separation has occurred, shall transmit a firing signal to the posigrade rockets. Firing of the posigrade rockets shall provide a velocity increase of 28 feet per second for separation of the capsule from the adapter-sustainer complex.

3.12.5.4 ABORT SEQUENCE AFTER TOWER SEPARATION - (Continued)

d. The capsule-adapter separation sensor shall arm the satellite clock, which shall receive a reset command from the ground or by the astronaut to initiate the normal retrograde sequence as defined in Paragraph 3.12.5.1, Subparagraphs D4, E, and F.

SEQUENTIAL SCHEMATIC

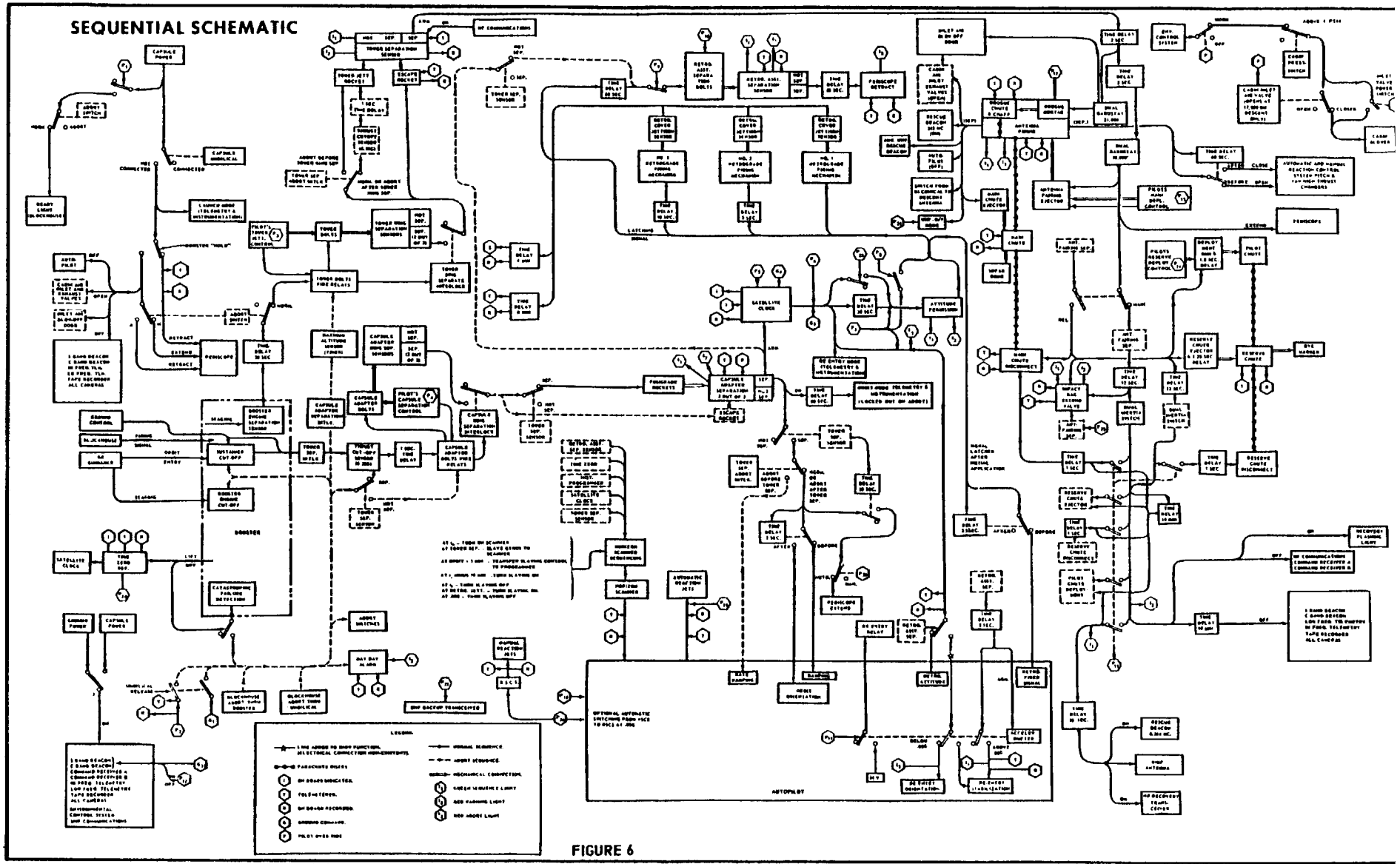


FIGURE 6

3.13 ELECTRICAL POWER SUPPLY SYSTEM - The electrical power supply system shall consist of six batteries which comprise the main, stand-by and isolated power supplies. Inverters shall be used for conversion of DC power to AC power. All batteries shall have individual diode reverse current protection for prevention of unnecessary power consumption because of a weak or faulty battery. Each battery shall be sealed at sea level pressure to withstand a pressure of 14.7 PSI both internally and externally, and shall have a pressure relief valve for maintaining internal pressure between 0 PSI and 14.7 PSI as required. The batteries shall be vented for release of gas only with vent lines passing through the large pressure bulkhead and terminating in the capsule skin between the bulkhead and the heat shield such that the gas vents overboard. Voltage monitoring shall be provided by the voltmeters located on the main instrument panel. Electrical loads shall be categorized as essential and nonessential and applied through separate busses to separate fuse panels. In event of low battery voltage, the nonessential bus automatically shall be switched off. The DC power control system shall be as depicted in Figures 7a and 7b, Pages 80 and 81.

3.13.1 MAIN POWER SUPPLY - The main power supply shall consist of three 3000 watt-hour silver-zinc batteries in accordance with Drawing No. 45-79707. (See Appendix I-C, Item 4 herein for electrical components.) Terminal voltage of these batteries shall average approximately 24 volts with a maximum of 29.6 volts and a minimum of 18 volts. The main batteries shall be wired in parallel with power inserted or withdrawn from the parallel circuit by an adjacent ON-OFF switch. The main batteries shall be capable of providing power requirements for the mission as defined in Paragraph 1.1.1 herein.

3.13.2 STAND-BY POWER - The stand-by power supply in accordance with Drawing No. 45-79707, shall consist of two 1500 watt-hour silver-zinc batteries with voltage taps of 24, 18, 12 and 6 volts. The stand-by batteries shall have capacity sufficient to provide power to capsule equipment for one orbit as well as the 12-hour requirement for post-landing components. Selection of stand-by battery operation shall be made by a switch provided on the main instrument panel (see Paragraph 3.8.9.6). When the astronaut places the switch in the ON position, stand-by power shall be inserted into the main and secondary busses. The stand-by batteries shall have sufficient capacity to provide a power source for the rescue beacon and rescue voice communications.

3.13.2.1 ISOLATED POWER - The isolated power supply in accordance with Drawing No. 45-79707, shall consist of one 1500 watt-hour silver-zinc battery with voltage taps of 24, 18, 12 and 6 volts. The isolated battery system shall have sufficient capacity to provide power to the pyrotechnic-actuated devices (see Paragraph 3.20). The isolated battery shall supply power to the audio bus for rescue communications if the AUDIO BUS switch is

3.13.2.1 ISOLATED POWER - (Continued)

placed in the EMERG position by the astronaut. Isolated battery power may be inserted into the stand-by battery circuit if the ISOLATED BATTERY switch is placed in the STAND-BY position by the astronaut.

3.13.3 AC POWER SYSTEM - The AC power system shall consist of two main and one stand-by static inverters and filters for conversion of 24-volt DC power to 115-volt, single-phase, 400-cycle AC power. An inverter cooling system in accordance with Drawing No. 45-83135 shall be provided. This system shall utilize freon from the capsule umbilical connection (see Paragraph 3.13.4.1) as necessary during prelaunch operations, and water from the ECS coolant tank from umbilical separation throughout the mission. Air from the cabin fan (see Paragraph 3.9.1.2.3) shall be directed to the vicinity of the inverters through a screened duct installation in accordance with Drawing No. 45-83144 to assist in dissipating heat resulting from inverter operation.

3.13.3.1 MAIN AC POWER SYSTEM - The main AC power system shall consist of one 250 volt-ampere (VA) static inverter and one 150 VA static inverter, in accordance with Drawing No. 45-79709. The 250 VA inverter shall supply AC power to the ASCS, horizon scanners, rate indicating system and humidity indicator, and cabin lights. The 150 VA inverter shall supply AC power to the environmental control system fans. The inverters shall supply AC power as specified during the launch, orbit and re-entry phases of the mission as described in Paragraph 1.1.1 herein.

3.13.3.2 STAND-BY AC POWER - The stand-by AC power system shall consist of one 250 VA static inverter in accordance with Drawing No. 45-79709. The stand-by inverter shall supply AC power to either or both the ASCS bus and fans bus, dependent upon the position of the ASCS AC BUS switch and the FANS AC BUS switch. If both switches have been placed in the NORM position and compound main inverter failure occurs, AC power shall be supplied to both the ASCS bus and fans bus by the stand-by inverter. Upon failure of either of the main inverters, the appropriate circuit shall be de-energized and the stand-by inverter shall supply AC power to the equipment formerly powered by the main inverter. If both switches have been placed in the STBY position, AC power shall be supplied to both the ASCS bus and fans bus by the stand-by inverter. Either the ASCS AC bus or the fans AC bus may be removed from the AC circuit by placing their respective switches in the OFF position. This shall remove either DC power from the respective main inverters or the AC output of the stand-by inverter dependent upon the source of the AC power.

3.13.4 ELECTRICAL CONNECTIONS - Design of the electrical system shall be such that there shall be no exposed electrical connections within the capsule to allow shorting by corrosive atmosphere and floating debris.

3.13.4.1 UMBILICAL CONNECTIONS - In order to maintain a fully-charge condition on the batteries and to provide power for ground testing of various systems within the capsule, external power shall be su to the capsule prior to launching through an umbilical plug and disconnec assembly in accordance with Drawing No. 45-79723. This plug shall be atta to the capsule mating receptacle through the open periscope door. The umb ical coupling device shall afford a secure and positive capsule connectior which shall be capable of being released both electrically by a solenoid release mechanism and manually by a lanyard release. It shall be the func of the umbilical connection to provide for the transfer of Freon 114 to th capsule during prelaunch operations.

D.C. POWER CONTROL SYSTEM SCHEMATIC

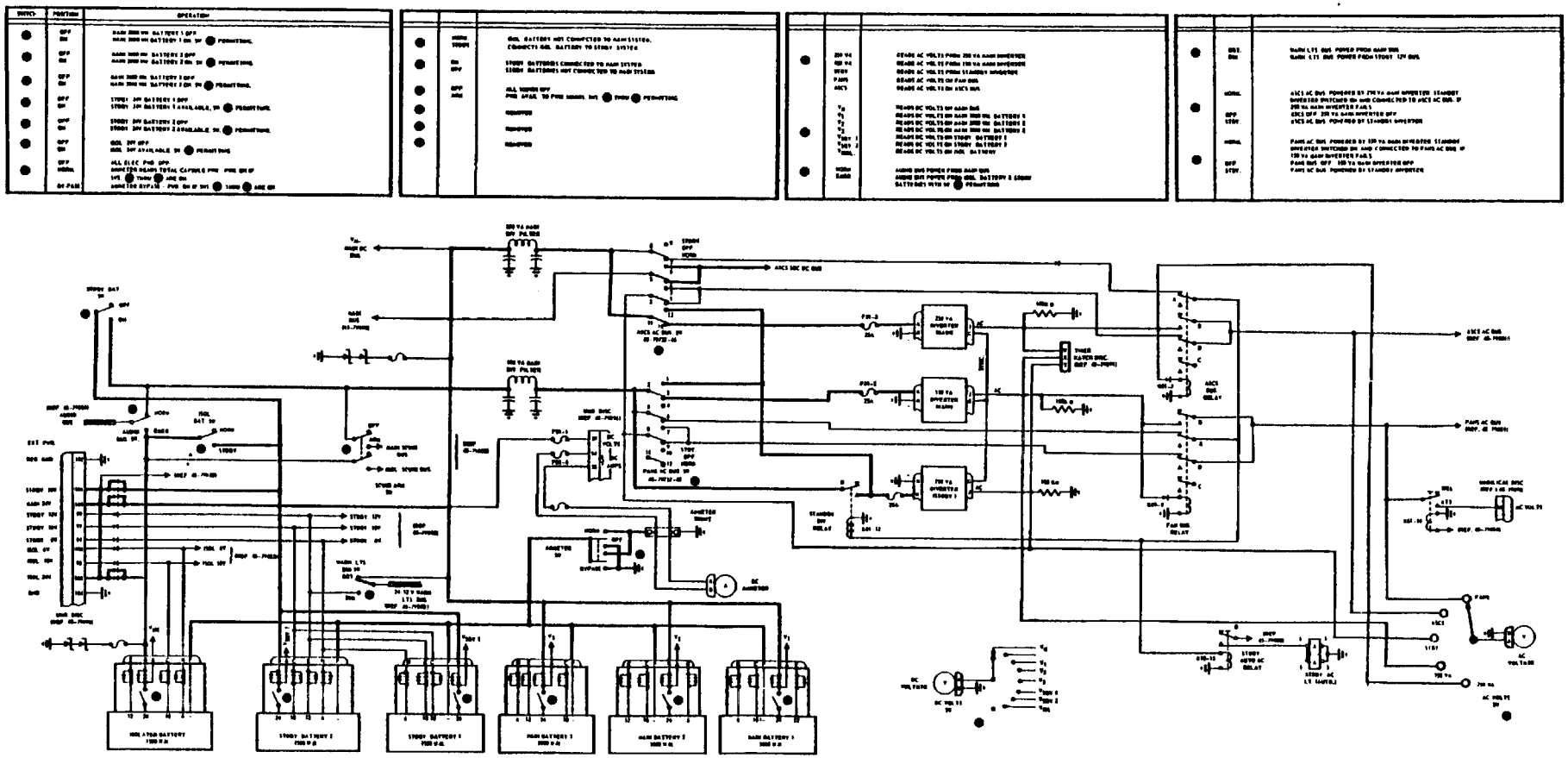


FIGURE 7-a

D.C. POWER CONTROL SYSTEM SCHEMATIC

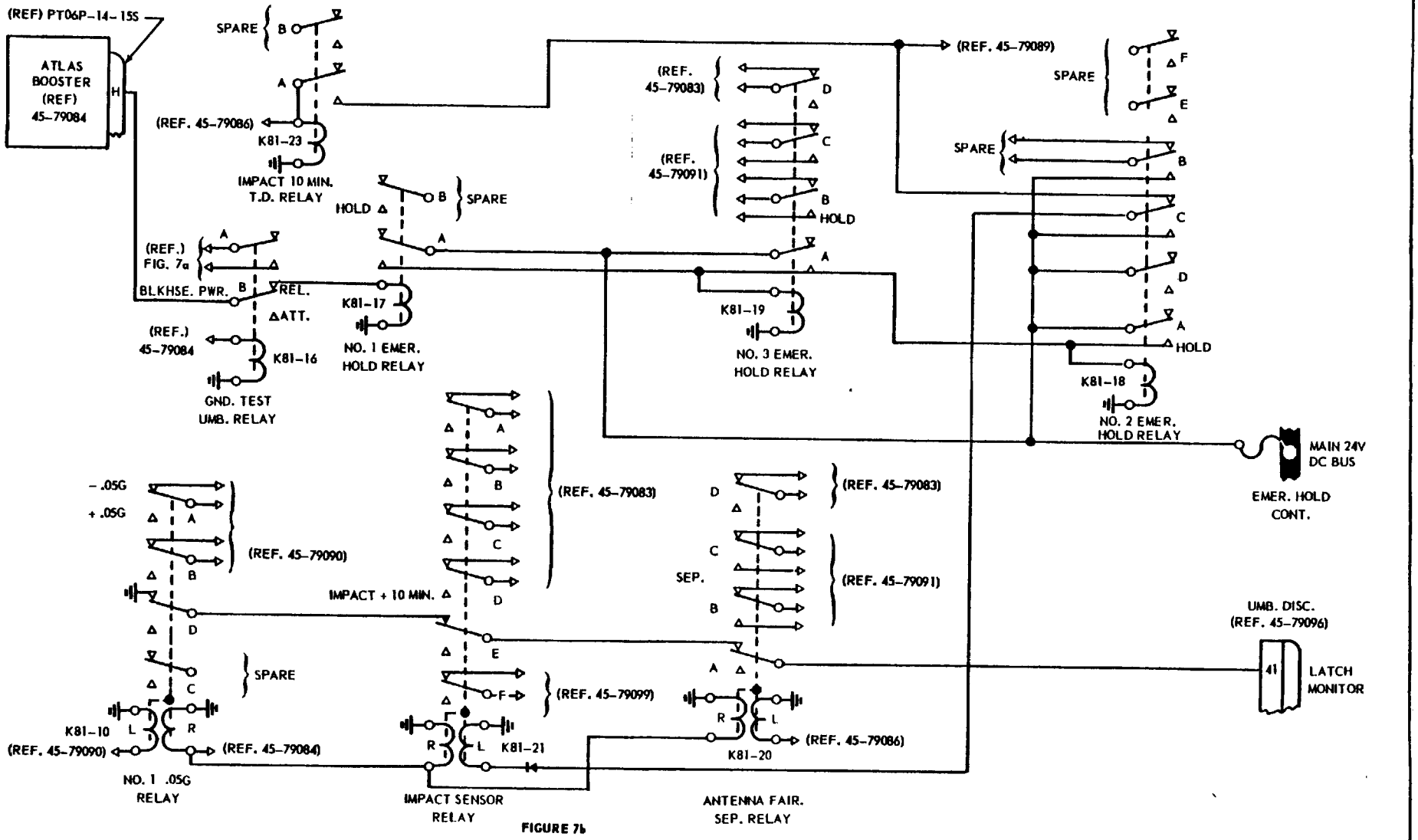


FIGURE 7b

3.14 COMMUNICATIONS SYSTEM - The communication systems provided aboard the Mercury capsule shall be compatible with the world-wide ground station complex. Wherever practicable, existing systems of telemetry, tracking, and voice communications will be used. The following systems of communications in accordance with Drawing No. 45-85700 shall be provided aboard the capsule:

a. Two-way HF/UHF orbital voice communications

b. Command receivers - ground to capsule

c. Telemetry equipment - capsule to ground

d. C-Band radar tracking beacon

e. S-Band radar tracking beacon

f. HF/UHF - Rescue beacon

g. HF Rescue voice communication

h. UHF back-up orbital voice communications

i. UHF Auxiliary rescue beacon.

3.14.1 TWO-WAY HF/UHF ORBITAL VOICE COMMUNICATION - The two-way orbital voice communication systems shall consist of an amplitude-modulated HF transmitter-receiver and UHF transmitter-receivers. The HF transmitter-receiver shall operate on a 15.016-megacycle frequency and shall have a 5.0 watt RF output and a sensitivity such that not more than 5 microvolts shall be required for 10 DB signal-to-noise ratio and shall contain provisions for 12 DB level speech clipping. The UHF transmitter-receivers shall operate on 296.8 megacycles and shall have a 3.5-microvolt sensitivity for 10 DB signal-to-noise ratio and contain provisions for 12 DB level speech clipping. The basic UHF unit as described herein and back-up UHF unit as described in Paragraph 3.14.4.3.3 shall be identical units having a 0.5 watt power output. The basic unit shall drive a 2.0 watt amplifier. A UHF SELECT switch located on the radio section of the instrument panel (as depicted in Figure 3, Page 51 herein) and labeled HI PWR and LO PWR shall permit the astronaut to switch from the basic UHF unit with the 2.0 watt power output to the back-up 0.5 watt UHF unit. Either of the UHF units as selected by the astronaut shall be automatically energized at antenna assembly jettison and shall transmit continuously for direction finding in the recovery phase.

3.14.1.1 AUDIO CENTER - The audio center shall contain a voice-controlled transmit-receive relay (VOX) and associated circuitry to activate the selected transmitter-receiver. Provisions shall be incorporated to permit the astronaut to adjust the threshold level of the VOX. The unit shall also contain transistorized audio amplifiers for microphone and headphone circuits, a voice filter for the command receivers, and associated relays and switches. This unit shall be automatically energized when the VOX PWR switch is placed in the ON position. When the VOX PWR switch is placed in the OFF position, the astronaut must depress the "push-to-talk" microphone button (see Paragraph 3.8.8.2.2) to transmit via the voice communication unit selected.

3.14.2 COMMAND RECEIVER SYSTEM - Two frequency modulated transistorized command receivers, similar to AN/DRW-13 receivers, and two command decoders shall be provided. Each command system shall provide a total of twenty decoder outputs, consisting of ten channels in each of the receivers and ten channels in each of the two decoders provided. Each command receiver shall operate on a frequency of 414.0 megacycles and shall be compatible with FRW-2 ground command transmitters. The receivers shall provide simultaneous operation of five decoder channels, with a sensitivity such that not more than five microvolts input signal is required from 20 degrees centigrade through 30 degrees centigrade with a deviation of ± 60 KC per channel. From zero degrees centigrade through 20 degrees centigrade and from 30 degrees centigrade through 71 degrees centigrade, the sensitivity shall be such that not more than seven microvolts is required with a deviation of ± 60 KC per channel. The command receiver system shall accept and decode the following commands (parenthetical numbers indicate symbols shown on sequential schematic, Figure 6, Page 76): abort (G-1); satellite clock reset (G-4); retrograde rocket fire (G-5); S and C-Band beacons ON (G-11); and zero and full-scale instrumentation calibration. Verification of commands shall be telemetered. Receipt of a retrograde rocket firing reset command shall be indicated by an amber warning light located on the warning light panel (see Paragraph 3.8.9.4.1). It shall be possible to use the command receivers for emergency voice communications.

3.14.3 TELEMETRY - Telemetry equipment to be provided shall be a high frequency telemetry transmitter, a low frequency telemetry transmitter, and power supplies. Data shall be telemetered to ground stations to provide necessary real time information concerning the astronaut, capsule, and life support system. Telemetry shall afford back-up in the event that on-board data are not retrieved. Reliability shall be obtained through the use of two independent telemetry systems. Both telemetry systems shall remain energized for ten minutes after impact (see Paragraph 3.17.3.5).

3.14.3.1 LOW FREQUENCY TELEMETRY TRANSMITTER - The low frequency telemetry transmitter shall operate on 225.7 megacycles with a transmitter power output of 3.3 watts. This unit shall transmit scientific and aeromedical information by means of six IRIG standard FM subcarriers, one containing PAM modulation (10.361 KC subcarrier) which shall provide 88 data samples plus two sync pulses for references, each measured 1-1/4 times per second. This unit shall be capable of 4-1/2 hours continuous operation.

3.14.3.2 HIGH FREQUENCY TELEMETRY TRANSMITTER - The high frequency telemetry transmitter shall operate continuously on 259.7 megacycles with a transmitter power output of 3.3 watts. This unit shall have the capability of transmitter power output of 0.6 watts by a simple ground modification required for conversion to the lower power.

3.14.3.3 TELEMETRY POWER SUPPLY - Two identical transistorized power supplies shall be provided, one for each transmitter. The power supplies shall operate from the capsule DC power supply.

3.14.3.4 TELEMETRY LINE FILTER - A telemetry line filter shall be provided in order to alleviate the possibility of activating the command receivers spuriously. The line filter shall reduce conducted RF energy which is being fed directly back from the high frequency telemetry transmitter into the capsule wiring to a level compatible with satisfactory system operation.

3.14.4 TRANSPONDERS AND BEACONS

3.14.4.1 C-BAND BEACON - The C-band radar tracking beacon shall be compatible with the FPS-16 radar system. The C-band beacon transponder shall consist of a transistorized receiver operating on a 5480-megacycle frequency and a transistorized transmitter (except for its magnetron) operating on a 5555-megacycle frequency. The transponder RF input shall be double-pulse coded and shall provide sufficient receiver sensitivity to normally attain a 1000 statute mile (868 nautical mile) range at orbital altitude. Power output of this unit shall be 375 watts peak. The C-band beacon shall incorporate a lockout feature which shall prevent interrogation during the beacon power supply recovery time.

3.14.4.2 S-BAND BEACON - The S-band radar tracking beacon shall be compatible with the SCR-584 Mod. II radar and the VERLORT long range radar. The S-band beacon transponder shall consist of a transistorized receiver operating on a 2840-megacycle frequency and a transmitter operating on a 2910-megacycle frequency. The transponder input shall be double-pulse coded and shall provide sufficient receiver sensitivity to normally attain a 1000 statute mile (868 nautical mile) range at orbital altitude. Power output of this unit shall be 1000 watts peak. The S-band beacon shall incorporate a lockout feature which shall prevent interrogation during the beacon power supply recovery time.

3.14.4.3 RECOVERY AIDS

3.14.4.3.1 HF/UHF RESCUE BEACON - The rescue beacon shall facilitate recovery operation. This unit shall be an HF/UHF MCW/pulse-modulated unit containing 243 megacycle SARAH rescue beacon and 8.364 megacycle MCW portion of the SEASAVE beacon. The HF beacon shall have a transmitted power output of 1.0 watt and the UHF beacon shall have a transmitted peak power of 7.5 watts. The UHF portion of the rescue beacon shall have a line-of-sight range of at least 100 nautical miles.

3.14.4.3.1.1 UHF AUXILIARY RESCUE BEACON - The UHF auxiliary rescue (Super SARAH) beacon shall be primarily for establishing contact with airborne search vehicles and shall have a line-of-sight range of at least 100 nautical miles. This unit shall consist of a UHF transmitter operating on 243 MC. The beacon shall receive its power from the 1500 watt-hour stand-by batteries through the stand-by bus and shall be capable of transmitting peak power of 90 watts with an input of 6.2 volts DC for a period of twenty-four hours. The unit shall be energized at antenna assembly separation. Provisions shall be incorporated to prevent the auxiliary beacon transmitter from radiating into the folded antenna (see Paragraph 3.14.6.6) during testing.

3.14.4.3.2 HF RESCUE VOICE COMMUNICATIONS - The HF rescue voice communication system shall consist of an amplitude-modulated HF transmitter-receiver using the same basic modules as the HF orbital voice communication system described in Paragraph 3.14.1 except that the rescue unit shall have a power output of 1.0 watt. This unit shall receive its power from the 1500 watt-hour isolated battery.

3.14.4.3.3 UHF BACK-UP ORBITAL VOICE COMMUNICATIONS - The UHF back-up orbital voice communication system shall consist of an amplitude-modulated UHF transmitter-receiver using the same basic modules as the UHF orbital voice communication system described in Paragraph 3.14.1, except that the back-up unit shall have a 0.5-watt power output and will not drive the 2.0-watt amplifier. This unit shall be automatically energized at antenna assembly jettison for continuous transmission for direction finding in the recovery phase if selected by the astronaut. This unit shall have a useful range of at least 200 nautical miles when operated in conjunction with compatible rescue equipment. Power for this unit shall be received from the 1500 watt-hour isolated battery.

3.14.5 COMMUNICATIONS CONTROL PANEL - A communications control panel shall be provided in the lower right-hand corner of the instrument panel. The control panel shall contain audio mixing circuitry, volume controls for the HF, UHF and emergency command voice channels, a Morse code keying button for high frequency telemetry transmission control, and direction finding switch which shall enable the astronaut to use the energized UHF

3.14.5 COMMUNICATIONS CONTROL PANEL (Continued)

transmitter-receiver as selected for normal transmission and reception. The volume controls shall be vertically mounted. It shall be possible for the astronaut to rotate the volume controls with a fully inflated pressure suit by gripping the edge of the instrument panel with his fingers and rotating the control with his thumb. A "push-to-talk" microphone button shall be provided on the abort handle (see Paragraph 3.8.8.2.2). This button must be used by the astronaut for transmission via the selected communications unit when the VOX PWR switch is in the OFF position. The communications audio control shall receive aural alarm signal inputs from the warning system tone generator (see Paragraph 3.8.9.4.1). The aural alarms shall result in a steady tone audible through the astronaut's headset.

3.14.6 ANTENNAS - Antennas shall be provided for all communication systems. Antennas for each system shall provide the required coverage for each phase of the mission. Recovery system antennas shall be mounted in such a manner as to prevent loss of signal from water or salt spray. Multiplexers, diplexers, coaxial switches and miscellaneous RF components shall be utilized where necessary to limit the number of antennas. Antenna and cable losses shall be minimized consistent with all other capsule requirements.

3.14.6.1 C AND S-BAND ANTENNA - A C and S-Band antenna system capable of operation during all phases of the mission shall be provided. The C and S-Band beacons shall remain energized until 10 minutes after impact through a time delay energized by the landing system dual inertia switch as indicated on the sequential schematic, Figure 6, Page 76. This antenna system shall consist of three flush helices for each of the two beacons to provide omnidirectional coverage, with a power divider for each of the two beacons and matched cabling from the power dividers to the antennas. A phase shifter shall be installed in one cable to improve radar reception during capsule turn-around. Each antenna shall be capable of separate or simultaneous operation. The C and S-Band antennas shall be externally located in a band around the capsule conical section near the junction of the cylindrical recovery compartment.

3.14.6.2 BICONICAL ANTENNA - The biconical antenna shall operate during prelaunch, launch, orbit, and re-entry phases of the mission. This antenna shall be incorporated in, and jettisoned with, the communications antenna assembly (see Paragraph 3.5.6). Through a multiplexing system, the HF and UHF orbital voice communications, both UHF command receivers, and both telemetry transmitters shall utilize the biconical antenna.

3.14.6.2.1 MULTIPLEXER - A multiplexer shall be provided to permit simultaneous or individual operation of HF/UHF transmitter-receivers (excluding DF mode of UHF), high and low frequency telemetry transmitters, and

3.14.6.2.1 MULTIPLEXER (Continued)

both command receivers into the biconical antenna. The multiplexer shall be compatible with the UHF descent antenna for use after jettison of the biconical antenna. This unit shall be located in the capsule pressurized area.

3.14.6.3 UHF DESCENT ANTENNA - A wire butterfly-type descent antenna shall be provided for supplying omnidirectional coverage. This antenna shall permit simultaneous operation of both telemetry transmitters, UHF back-up voice transmitter-receiver, UHF rescue beacon, and UHF command receivers. The descent antenna shall be located on the capsule parachute housing structure. This antenna shall be tethered until after main chute (or reserve chute) deployment to prevent possible damage from the chute risers. This antenna shall be spring-loaded and shall be extended into the erect operating position after a 16-second time delay from antenna fairing separation by means of a reefing cutter which shall sever the tie-down cord upon actuation.

3.14.6.4 HF RESCUE ANTENNA SYSTEM - A telescopic whip-type antenna shall be provided for use with the HF rescue beacon and the HF rescue voice transmitter-receiver. This antenna shall be stowed in the recovery compartment and shall be automatically extended by the landing system dual inertia switch (see Paragraph 3.17.3.5). The antenna shall extend to a nominal length of 16 feet when in operating position.

3.14.6.5 HF DIPLEXER - An HF diplexer shall be provided for use during the recovery phase to connect the output of the HF portion of the HF/UHF rescue beacon and the HF rescue voice transmitter to the HF rescue (whip) antenna. The diplexer shall be located in the capsule pressurized area.

3.14.6.6 UHF AUXILIARY RESCUE BEACON ANTENNA - An independent ribbon-type antenna system shall be provided for operation of the Super SARAH beacon only, and shall be erected at antenna assembly jettison.

3.14.7 COAXIAL SWITCHES - Two single-pole, double-throw, motor-operated coaxial switches shall be provided for switching from the biconical antenna to the UHF descent antenna upon main parachute deployment and for switching to the UHF back-up voice transmitter-receiver, as selected by the astronaut.

3.14.8 COAXIAL CABLES AND CONNECTORS - Raytherm Type 12-080S, 12-233 or 12-234 coaxial cable shall be used for all interconnections between the electronic equipment and antennas. Coaxial connectors shall be of the miniature type.

3.14.9 BICONE ISOLATOR - A bicone isolator shall be provided to permit the routing of electrical cables through the faces of the biconical antenna without picking up any RF signals in the wiring which would be detrimental to the system. The bicone isolator shall be located in the biconical antenna assembly and shall be compatible with capsule structure.

3.15 RECORDING EQUIPMENT - Recording equipment meeting the requirements of Specification MIL-E-5272A-1 and MIL-E-5400B(ASG) shall be comprised of equipment as specified in the following paragraphs. A satisfactory isolation technique shall be employed to avoid crosstalk or interference between systems being fed from common pickups. Methods of data recording within the capsule shall be as noted below, and as depicted in Figure 8, Page 93 herein. In addition telemetry equipment for transmitting data from the capsule to ground stations shall be provided as specified in Paragraph 3.14.3.

a. Photographic recording of astronaut.

b. Photographic recording of instrument panel.

c. Tape recording of data and voice.

d. Photographic recording of cosmic ray collisions.

3.15.1 CAMERAS - Cameras shall be provided as follows:

a. ASTRONAUT OBSERVER CAMERA - A 16mm motor operated camera in accordance with Drawing No. 45-88111 shall be provided for observation and recording of the astronaut's motion and appearance in conjunction with clock/camera correlation at booster liftoff (see Paragraph 3.15.1.1). Film capacity of the camera shall be 250 feet (10,000 frames) using Cronar Base 16mm film. The camera shall be capable of high and low speed modes of operation. The mode of operation shall be determined by the camera contained programmer as depicted in Figure 8, Page 93. Frame rates in the high and low speed modes of operation shall be adjustable with high speed frame rates from six frames per second to one frame per second and low speed frame rates from one frame per four seconds to one frame per sixteen seconds. For the mission of this capsule the high and low speed modes shall be set for 6 frames per second and one frame per twelve seconds respectively. In addition the camera shall be capable of operation in a cine-action (free running) mode. Application of power to the cine-action mode will override the high or low speed modes if either are in operation. The camera shall function until ten minutes after capsule impact.

b. INSTRUMENT OBSERVER CAMERA - A 16mm motor operated camera in accordance with Drawing No. 45-88110 shall be provided for observation and recording of the instrument panel displays. Film capacity of the camera shall be 450 feet (18,000 frames) using Cronar Base 16mm film. The camera shall be capable of

3.15.1 CAMERAS - (Continued)

high and low speed modes of operation. The mode of operation shall be determined by the camera contained programmer as depicted in Figure 8, Page 93. Frame rates for the high and low speed modes shall be adjustable with high speed frame rates from six frames per second to one frame per second and low speed frame rates from one per second to one per ten seconds. For the mission of this capsule the high and low speed modes shall be set for six frames per second and one frame per two seconds respectively. In addition the camera shall be capable of operation in a cine-action (free running) mode. Application of power to the cine-action mode will override the high and low speed modes if either are in operation. The camera shall function until ten minutes after capsule impact.

3.15.1.1 CAMERA CORRELATION CLOCK - A camera correlation clock assembly in accordance with Drawing No. 45-88112 shall be provided. This assembly shall consist of a type A-13A 8-day clock and a correlation light, mounted on a panel to the upper right of the astronaut. The clock shall be edge-lighted to provide good camera readout and oriented so as to present its full face to the astronaut observer camera. The clock shall be used for chronological correlation of astronaut motion and appearance during the mission, as recorded in the astronaut observer camera. The correlation light shall be de-energized at liftoff to establish a "Time Zero" indication in the astronaut observer camera.

3.15.2 TAPE RECORDER - A tape recorder in accordance with Drawing No. 45-88707, shall be provided for permanent data storage. The recorder shall function continuously during all phases of the mission and for 10 minutes after impact for recording of astronaut comments and observations. All voice messages sent to ground stations by the astronaut shall be recorded by this equipment. The tape recorder shall be compatible with the pulse duration modulation system, voltage-controlled subcarrier oscillators (VCO) and direct recording media. This unit shall have seven heads for recording data at a tape speed of 1-7/8 ips. Tape capacity shall be 3600 feet of 1/2 inch 1 mil mylar-base tape. A limit switch shall be provided for interrupting power to the recorder in event of tape breakage. Recording tracks shall be as follows:

Track No. 2 - Direct Recording - VCO output - HF system

Track No. 3 - Direct Recording of UHF voice below 3125 CPS

3.15.2 TAPE RECORDER - (Continued)

Track No. 5 - Pulse Recording - composite PDM signal from commutator-keyer unit - LF system (see Figure 8)

Track No. 6 - Pulse Recording - composite PDM signal from commutator-keyer Unit - HF system (see Figure 8)

Track No. 7 - Direct Recording - VCO Output - LF system

3.15.2.1 COMMUTATED DATA RECORDING - Two commutator-keyer-record amplifier units, in accordance with Drawing No. 45-88728, shall be provided. Each unit shall be capable of integrating 88 DC inputs from the various transducers depicted in Figure 8, Page 93, plus two internally generated synchronizing pulses, into a continuous 90 x 1-1/4 standard IRIG signal wave train. Outputs shall be compatible with the on-board tape recorder and telemetry systems.

The commutator portion of each unit shall receive DC inputs as described above and shall provide a continuous 112-1/2 pulse-per-second pulse amplitude modulation (PAM) signal output. The PAM signal shall be simultaneously delivered to a converter section and a gating circuit within the unit. The converter section shall provide a pulse duration modulation (PDM) signal which, after amplification, is capable of driving a recording head in the on-board tape recorder. The gating circuit shall serve as an introduction point for the synchronizing pulses and shall reduce the duty cycle of the PAM signal to a duration suitable for application to the 10.361 KC VCO's. The telemetered signal from these VCO's shall be suitable for use in ground station automatic decommutation equipment. Each unit shall contain circuitry which is capable of providing required operating voltages from capsule power.

3.15.3 COSMIC RAY FILM PACK - Provisions for installation of four photographic recorders of cosmic ray collisions shall be incorporated in the capsule. The recorders shall be furnished by NASA and shall be installed at the launch site (see Appendix I-A).

3.15.4 DATA PROGRAMMER - A data programmer in accordance with Drawing No. 45-88710 shall be provided. The programmer shall consist of Sections A and B. Section A shall program operation of the camera and water extractor at a rate of 30 seconds per each 30 minutes; blood pressure system initiation signal at a rate of 5 seconds per each 30 minutes; and gyro slaving to horizon scanners at a rate of 8.5 minutes per each 30 minutes. Upon receipt of a command signal from auxiliary decoder "A" or "B", Section B shall provide a 3 second signal for blood pressure system initiation. Section B shall be capable of recycle in 5 seconds with a continuous imput signal or upon receipt of a new command signal.

3.15.5 VOLTAGE CONTROLLED SUBCARRIER OSCILLATORS - Voltage-controlled subcarrier oscillators (VCO's) in accordance with Appendix I-C, shall be provided. The VCO's shall receive inputs from the various sources shown in Figure 8, Page 93, and, in conjunction with two resistor assemblies, a mixer amplifier (see Paragraph 3.15.6), and an isolation amplifier (see Paragraph 3.15.7), shall provide input signals for the telemetry transmitters, tape recorder, and hard-line circuits.

3.15.5.1 REFERENCE OSCILLATOR - A 3000 cps fixed-frequency oscillator in accordance with Appendix I-C, shall provide a reference signal for monitoring tape recorder wow and flutter.

3.15.6 MIXER-AMPLIFIER - A mixer-amplifier in accordance with Appendix I-C shall be provided for amplifying VCO outputs to the high frequency telemetry transmitter and isolation amplifier.

3.15.7 ISOLATION AMPLIFIER - A dual-section isolation amplifier assembly in accordance with Drawing No. 45-88234 shall be provided. One section shall amplify VCO output to the HF hard-line circuit and incorporate provisions for adjustment of the signal level applied to the HF telemetry transmitter and track 2 of the tape recorder. The remaining section shall perform identical functions for the LF hard-line circuit, LF telemetry transmitter and track 7 of the tape recorder.

DATE 18 January 1962

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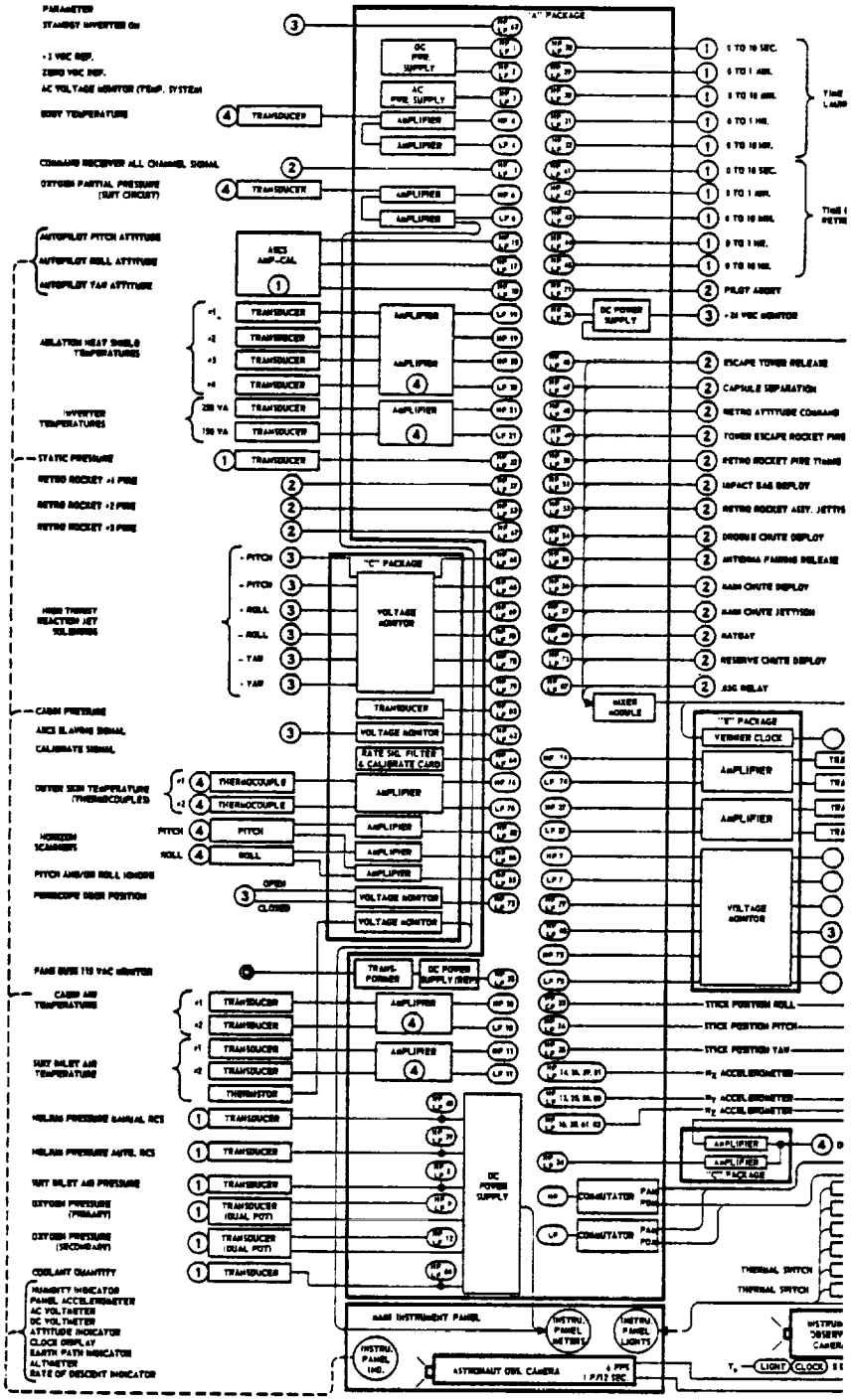
ST. LOUIS, MISSOURI

[redacted]

BASIC INSTRUMENTATION BLOCK



[redacted]

3.16 NAVIGATIONAL AIDS - The astronaut shall be provided with manual navigational aids which, on an orbital mission, shall allow basic navigation without communication or automatic system references. (See Paragraph 3.8.9.5 for dead reckoning earth path indicator.)

3.16.1 PERISCOPE - An optical periscope, in accordance with Drawing No. 45-86701, shall be provided. (See Appendix I-C, Item 3.18 herein.) This unit shall be located so as to partially support the instrument panel (see Paragraph 3.8.9) such that its display appears in the lower center of the instrument panel. This installation shall provide an optical reference point at Z 135.59, TY 5.780 and X0.00 station lines, based upon an astronaut's eye reference point at Z 118.20, TY 22.82 and RX 1.28. The periscope shall provide an 8-inch diameter circular display with the image plane inclination at approximately 45 degrees from the Y0.00 axis. The periscope circular display shall provide the following:

a. Outer view of the horizon circle.

b. Center downward view of the spherical earth.

c. High and low magnification of the center view of the point where the vertical intersects the earth's surface. The low magnification of the view shall give a 175-degree minimum field angle when observing from within the eye freedom circle. The high power magnification of the center field view shall provide a maximum of 19 degrees (true field). The magnification ratio between high and low power shall be 5.7:1 ± 6%. Magnification view shall be adjustable by actuation of the magnification control provided on the left-hand side of the periscope body.

d. Target index located in the center for definition of earth position relative to intersection of vertical with the earth's surface.

e. Adjustable altitude indices and visual altitude indication.

f. Attitude indices for indication of pitch and roll attitude.

g. 34-degree (heat shield up) retrograde pitch attitude fixed indices.

h. Fixed reticle lines shall be provided for earth and sky camera field of view when capsule is aligned to vertical.

3.16.1 PERISCOPE (Continued)

i. Fixed reticle lines for alignment of the capsule normal axis with the earth vertical.

j. A 14° 30' (heat shield up) true vertical index on upper portion of display.

k. Drift indices and drift set scale for capsule orientation with the ground track.

l. Sun-moon index - a graduated, adjustable 360-degree index about the perimeter for measurement of the angle of the rising or setting sun or moon relative to the capsule longitudinal axis. A high-density sun filter shall be provided for viewing of the sun without eye discomfort or damage.

m. Clear, yellow, red or neutral density optical filters shall be manually selectable by the astronaut.

The lower optical portion of the periscope and the periscope access door shall extend or retract automatically with provisions for manual override. Automatic extension and retraction shall occur in less than five seconds each. An amber light located on the upper left of the periscope display shall illuminate at any time when the lower optical portion of the periscope is in any position between locked extended and locked retracted in the retract cycle.

3.16.1.1 PERISCOPE CONTROLS - The following controls shall be provided on the periscope:

a. Reticle illumination control knob
b. Altitude knob and indicator
c. Drift knob
d. Sun-moon index control lever

(On periscope face)

e. Two-position (high and low) magnification change lever - 30-degree total travel.
f. Four-position filter selector lever - 30-degree travel

(On Left-Hand Side of Body)

3.16.1.1 PERISCOPE CONTROLS (Continued)

g. Manual extension and retraction control lever - 45-degree total travel - On right-hand side of body.

3.16.2 NAVIGATIONAL AID KIT - A navigational aid kit in accordance with Drawing No. 45-81089 shall contain maps, cards, and a pencil. These navigational aids shall be bound together in a book-like fashion, in accordance with Drawing No. 45-81087, for simplicity, convenience, and ease of handling. The navigational aid kit shall be mounted to the periscope directly below the circular display. All navigational aid kit functions may be performed with inflated pressure suit gloves.

3.16.2.1 STEREOGRAPHIC MAPS - Polar stereographic maps in accordance with Drawing No. 45-81706 shall be provided.

3.16.2.2 CARDS - Check, chart, and note cards shall be provided as required by the mission as outlined in Paragraph 1.1.1.

3.16.2.3 PENCIL - A mechanical-type pencil shall be provided, suitable for writing on clear plastic. A pencil holder and retaining line shall be provided for pencil storage and retention.

3.17 LANDING, POST-LANDING AND SURVIVAL SYSTEMS - A capsule landing system shall be provided and shall consist of components tabulated in Appendix I-C herein, Item 10. The landing system in accordance with Drawing No. 45-41700 shall include two independent parachute systems, sequencing controls, and post-landing equipment. All parachutes, harnesses and parachute bags as specified herein shall be shipped directly to the launch site where they will be inspected and packed.

3.17.1 LANDING SYSTEM - The landing system shall consist of a primary system comprising a main parachute, a drogue parachute, and associated sequencing controls; and a reserve system comprising a reserve parachute, a pilot parachute, and associated sequencing controls. The landing system sequencing controls shall be armed by the tower separation sensor. For missions aborted between 10,000 feet and 21,000 feet, a time delay between escape tower jettison and drogue chute deployment of a minimum of two seconds shall provide a sufficient time lapse required for various functional sequences during the abort maneuver. For missions aborted at an altitude below 10,000 feet, a second time delay of two seconds shall prevent simultaneous actuation of the drogue mortar and the antenna assembly ejector.

3.17.1.1 DROGUE PARACHUTE SYSTEM - A six-foot diameter conical ribbon-type drogue parachute assembly, with a thirty-foot bridle length, shall be provided for adequate dynamic stability and deceleration during the re-entry phase. The drogue chute shall be constructed of cotton, nylon, and dacron materials and shall be designed for a dynamic pressure of 116 pounds per square foot, considering deployment at an altitude of 40,000 feet. The drogue chute shall be stowed in a drogue chute bag. The drogue chute assembly, a chaff packet compatible with C, S, and L-band radar, and a mortar sabot shall be located in the drogue mortar tube. At 21,000 feet altitude, a barostat (aneroid pressure switch) shall sense static pressure in the recovery compartment and close a switch, completing an electrical circuit to a cartridge squib located under the mortar tube, initiating a powder charge. The pressure shall force the mortar sabot and drogue chute assembly from the mortar tube causing the chute to deploy. The drogue chute shall be attached to the antenna assembly by a 3-riser arrangement and shall be released by jettison of the antenna assembly.

3.17.1.2 MAIN PARACHUTE SYSTEM - The main parachute assembly shall be a 63-foot diameter reefed (12 percent for 4 seconds) ring-sail-type parachute designed to provide a stabilized sinking speed of 30 feet per second at 5,000 feet altitude for a 2,160-pound capsule. The main parachute of nylon material shall be designed and constructed to withstand shock loads encountered at the deployment altitude which results in a dynamic pressure of 92 PSF. It shall be considered that there has been no velocity decrement occasioned by drogue chute deployment, so that drogue chute failure cases shall be completely covered. The main parachute shall be stowed in the

3.17.1.2 MAIN PARACHUTE SYSTEM - (Continued)

cylindrical recovery compartment aft of the conical afterbody. Its deployment bag lanyard shall be connected to the antenna assembly so that upon antenna jettison, the main chute, as it pulls out of the chute pack, shall be deployed. A parachute deployment bridle, fabricated from 750-pound tubular nylon webbing, shall be attached to the apex of the parachute in such a manner that the loads encountered upon parachute deployment shall be distributed symmetrically about the apex. This shall take place at 10,000 feet altitude as sensed by a barostat (aneroid pressure switch). The barostat shall complete an electrical firing circuit to the antenna ejector assembly subsequently jettisoning the antenna assembly. The barostat shall also initiate extension of the periscope. Upon separation of the antenna assembly, the main chute ejector gas generator assembly shall be electrically initiated, and shall produce gas for injection into the main parachute ejector bag, which, with the antenna assembly, shall eject the main chute pack from the recovery compartment. As this occurs, the main chute shall pull out of the main chute deployment bag, releasing the antenna assembly, drogue chute, and bag. At the time of main chute ejection, a SOFAR bomb, preset for detonation at a depth of 3,500 feet, shall be ejected. (See Paragraph 3.17.3.1.) Separation of the antenna assembly shall energize the cabin air inlet and exhaust valve "open" circuit for ventilation in low altitude abort maneuvers; energize the 243 MC SARAH rescue beacon and the auxiliary UHF rescue beacon; de-energize the ASCS; energize the UHF beacon for direction-finding mode; switch from the bicone antenna to the UHF descent antenna, simultaneously energize a 60-second time delay relay and power and control relay which shall open the reaction control system pitch and yaw high level thrust chamber solenoids to expel hydrogen peroxide and, after a 12-second time delay shall arm the impact sensor (dual inertia switch) and the impact bag extend valve. Gore colors of the main parachute shall be natural and international orange alternately arranged.

3.17.1.3 PILOT PARACHUTE - The pilot parachute shall be a flat circular type, with a 72-inch diameter and a 30-foot bridle length, constructed of nylon cloth, with nylon webbing and cord. The pilot parachute shall be designed for deployment in event of failure of the main parachute. Deployment of the pilot parachute shall be controlled by the astronaut through actuation of the RESERVE override control (P-14) located on the left-hand console. Upon actuation of this control, the main chute disconnect squib cartridge, the pilot chute deployment gun electric squib cartridge, and the reserve chute ejector bag gas generator shall be electrically initiated (provided antenna separation has occurred), and the main charge of the deployment gun shall be mechanically initiated by gas pressure from an initiator. The deployment gun electric squib and the mechanical ignition provisions for the main charge shall each incorporate 1-second time delays. The reserve ejector bag gas generator shall incorporate a 1.25-second time delay. After

3.17.1.3 PILOT PARACHUTE - (Continued)

runout of the 1-second time delay, the deployment gun main charge shall eject the deployment gun projectile assembly to which the pilot chute bridle assembly shall be attached. The bridle assembly shall be attached to the projectile assembly on one end and to the pilot chute canopy on the other. Upon extraction of the pilot chute from the reserve chute bag, its lanyard shall pull the bag from the recovery compartment. The reserve chute shall then pull out of the bag, which is permanently attached to the apex of the reserve chute to assist development of a more symmetrical chute deployment.

3.17.1.4 RESERVE PARACHUTE - The reserve parachute assembly shall be a 63-foot diameter reefed ring-sail-type parachute identical in design, construction, and reefing to the main parachute. The reserve parachute shall be stowed in the cylindrical recovery compartment. Its deployment bag shall be attached to the pilot chute lanyard, so that upon deployment of the pilot chute, the reserve chute deployment bag shall be extracted. As the pilot chute deploys, the reserve ejector gas generator assembly shall be electrically initiated and shall produce gas for injection into the reserve chute ejector bag which, with the pilot chute, shall extract the reserve chute pack from the recovery compartment. At the time of reserve chute ejection, a fluorescein dye marker package, attached to the capsule by a lanyard, shall be ejected. (See Paragraph 3.17.3.2.) In a normal landing sequence where the reserve chute has not been deployed, the reserve chute shall be ejected from the capsule through the RESCUE toggle switch (P-15) after the impact sensor (dual inertia switch) has become energized. The reserve chute shall also be ejected after runout of a 10-minute time delay which shall become energized by closure of the impact sensor (dual inertia switch) upon impact. (See Paragraph 3.17.3.5.) This time delay shall bypass the RESCUE toggle switch and shall energize the same circuitry as this switch.

3.17.2 IMPACT SKIRT - The capsule shall be equipped with a fiberglas/silicon rubber-impregnated impact skirt complying with Drawing No. 45-32700. The impact skirt shall be attached to the capsule structural assembly by a skirt retainer ring at 120 points and to the capsule heat shield at 189 points equally spaced around the heat shield on a radius of approximately 36 inches from the Z axis per Drawing No. 45-32300 and shall be capable of withstanding landing impact loads for water and earth landings as specified in M.A.C. Report No. 6693. A large pressure bulkhead shield conforming to Drawing No. 45-32290 shall be installed between the large pressure bulkhead and the heat shield in accordance with Drawing No. 45-32002, and shall prevent the heat shield from damaging the pressure bulkhead upon landing. The impact skirt shall be capable of extension by both automatic and manual systems.

3.17.2 IMPACT SKIRT - (Continued)

Automatic extension shall take place 12 seconds after antenna assembly separation, provided the LANDING BAG switch is in AUTO position. At this time, the explosive valves on the heat shield release system shall be ignited releasing pressure from the pneumatic tank which shall actuate the heat shield release mechanism allowing the heat shield to drop down and extend the impact skirt. This allows two landing bag unlock signal limit switches to return to a normal position which energizes the green LANDING BAG telelight. Upon impact, air is forced out of orifices near the bottom of the impact skirt allowing the capsule to settle to a normal attitude within seconds after impact. Upon impact the inertia switch shall energize a 1-second time delay relay and the astronaut's rescue aids. Runout of the 1-second time delay relay shall disconnect the main chute, provided the RESCUE switch (see Paragraph 3.8.9.4) is in MAN position.

When the control relay for the landing bag extend valve is energized, a two-second timer shall start simultaneously. If, after two seconds, the limit switches have not returned to a normal position, the LANDING BAG telelight shall illuminate red. The astronaut can then use a parallel circuit to fire the explosive valves by placing the LANDING BAG switch in the MANUAL position.

3.17.3 POST-LANDING SYSTEM - The post-landing system shall include one SOFAR bomb, a fluorescein dye marker package, a shark repellent package, a recovery flashing light, and inertia switches for actuation of equipment essential to recovery.

3.17.3.1 SOFAR BOMBS - Two SOFAR bombs shall be installed. In a normal landing sequence, one of these, preset to detonate at a depth of 3500 feet, shall be ejected at main chute deployment. The second bomb shall be permanently mounted to capsule structure and preset to detonate at a depth of 4000 feet to indicate that the capsule has submerged to an unrecoverable depth.

3.17.3.2 FLUORESCEIN DYE MARKER - A fluorescein dye marker packet assembly shall be provided to aid in visual location during the search phase. In a normal landing sequence, the fluorescein dye marker shall be ejected after reserve chute ejection and impact on the water. In a landing where the reserve chute has been deployed, the fluorescein dye marker shall be ejected with the reserve chute. The fluorescein dye marker shall be packaged in a water soluble container enclosed by a perforated metal can attached to the capsule by a retainer line. Sponge rubber shall be installed around the periphery of the dye marker package to prevent damage to the capsule window.

3.17.3.3 SHARK REPELLENT - A shark repellent packet assembly shall be provided to aid in astronaut protection while in the water after egress. The sealed packet shall be attached to the large pressure bulkhead shield and shall be vented to prevent damage to the packet during rapid ascent of the capsule. Provisions shall be made for opening the packet at impact skirt extension.

3.17.3.4 RECOVERY FLASHING LIGHT - A high-intensity flashing recovery light in accordance with Drawing No. 45-86702 shall be provided. Flashing rate of the light shall be at least 15 flashes per minute at an intensity which shall be visible below 12,000 feet at a distance of approximately 50 nautical miles on a starlit moonless night at a relative humidity of at least 90 percent. The light shall have self-contained batteries.

3.17.3.5 IMPACT SENSOR - The impact sensor (dual inertia switch) shall perform the following functions:

a. Initiate main parachute disconnect, reserve parachute ejector and disconnect and the pilot parachute deployment gun (with RESCUE toggle switch (P-15) in MAN position).

b. Energize a ten minute time delay which shall, upon runout, initiate main parachute disconnect, reserve parachute ejector and disconnect, and the pilot parachute deployment gun, and energize a 30-second time delay relay for initiation of whip antenna extension, HF recovery transceiver and rescue beacon operation, in the event that the RESCUE toggle switch (P-15) is in AUTO position.

c. Energize HF rescue antenna for HF SEASAVE direction finding beacon and HF rescue transceiver.

d. Start recovery flashing light.

e. De-energize excess communications and instrumentation.

f. Energize a ten minute time delay relay which upon runout shall de-energize the S-Band and C-Band beacons, low and high frequency telemetry units, the tape recorder and cameras.

g. Energize a 30-second time delay relay (when the RESCUE switch (P-15) circuit is closed). This time delay relay shall initiate the HF whip antenna extension and energize the SEASAVE beacon and HF rescue transceiver.

3.17.4 SURVIVAL KIT - Survival Equipment as supplied by the Government (see Appendix I-A) shall be contained in a contractor-furnished container conforming to the requirements of Drawing No. 45-81029. The container shall be partitioned into two compartments; one (snap enclosed) for housing a NASA-furnished one-man raft and water bladder (see Paragraph 3.8.4); and one (zipper enclosed) for housing the balance of the survival gear. A lanyard, 96.0 inches long, with a snap fastener shall be provided to join the astronaut, survival kit and/or capsule together. A retention line shall be provided in the container for connecting the life raft and survival kit. Stowage provisions shall be made for the astronaut's suit neck dam and for the knife and flashlight at time of egress. The following items of survival equipment shall be supplied by the Government:

(1) One-man life raft

(1) Chemical desalting kit (for 8 pints)

(3) Dye marker packets

(1) Shark chaser packet

(1) Battery-powered survival light (ACR-4-E or equivalent)

(1) Signal mirror

(1) First aid kit consisting of:

Gauze compress
Gauze bandage
Three injectors*
Fifteen oxytetracycline tablets (4 grains each)
Six motion-sickness tablets (Meclizine - 3/8 grain each)
Muslin bandage

(1) Small cake of soap

(1) Tube of zinc oxide ointment (Approx. 2-1/2 oz.)

(1) Signal whistle

(1) Small can survival rations

(1) Approximately 18 full-size waterproof matches in waterproof metal container (additional match heads shall be contained in the survival knife handle)

(1) Sunglasses

* These items to be furnished and installed by NASA at launch site.

3.17.4 SURVIVAL KIT - (Continued)

(10 feet) Multi-braided nylon line (fish hooks shall be contained in survival knife handle)

(1) Small pocket knife

(1) SARAH radio beacon with antenna and battery (Ultra RB-5 and RB-7)

The survival kit shall be packed by the contractor and shipped to the launch site for installation in the capsule.

3.18 HANDLING PROVISIONS - A hoisting loop assembly in accordance with Drawing No. 45-32263 shall be provided for capsule pick-up by helicopter. The loop shall be attached to the recovery compartment structural assembly by two hoist loop support fittings. The hoist loop shall be constructed of 9,000 pound capacity dacron webbing with a fiberglas plastic spring strap taped to the dacron to cause the loop to erect upon ejection of the antenna assembly. Two auxiliary hoisting fittings in accordance with Drawing No. 45-32068, located diametrically opposite on capsule station line Z123.00, shall be provided.

3.19 SUPPORT EQUIPMENT - Support equipment for Mercury capsule shall be as separately negotiated in CCP 52 Series.

3.20 PYROTECHNICS - Pyrotechnic devices in accordance with Drawing No. 45-72001 (as specified in Appendix I-C, Item 11 herein) shall be provided for the following:

a. Umbilical disconnect

b. Capsule-adapter clamp ring separation

c. Tower clamp ring separation

d. Retrograde package release

e. Parachute deployment and disconnect

f. Antenna fairing ejection

g. Sound fixing and ranging (SOFAR)

h. Rescue antenna extension

i. Snorkel valve actuation

j. Heat shield release

k. Descent antenna release

l. Explosive hatch release

m. Snorkel inlet door jettison

n. Horizon scanner cover release

Pyrotechnics with the exception of snorkel valve and heat shield release squibs shall be installed at the launch site.

4.0 QUALIFICATION

4.1 M.A.C. QUALIFICATION - Qualification of equipment and subsystems shall be accomplished by M.A.C. or by subcontractors under M.A.C. direction as defined in M.A.C. Report 6495 and in component specification control drawings. Qualification status of parts shall be as tabulated in M.A.C. Report 8140, dated 27 March 1961, revised 5 September 1961.

4.2 NASA QUALIFICATION - The capsules supplied by the contractor will be used in a qualification flight test program to be conducted by the NASA. The capsule and its systems shall demonstrate satisfactory performance within the framework of this specification. This qualification program will have as its final objective the accomplishment of the mission described in Paragraph 1.1.1 herein, launching of a manned capsule into a semipermanent orbit and subsequent safe recovery to the surface of the earth at a designated time and/or position through use of retrograde thrust and aerodynamic drag.

5.0 TESTING

5.1 M.A.C. TESTING - The contractor shall undertake structural, aerodynamic, hydrodynamic, equipment, compatibility, acceptance, and evaluation tests as required in support of the capsule development program.

5.2 NASA TESTING - A program of research and development flight testing of Capsule No. 16 will be undertaken by the NASA. The capsule described herein shall be utilized in Mercury-Atlas Test Shot No. (8).

6.0 DEFINITIONS

NASA - National Aeronautics and Space Administration

M.A.C. - McDonnell Aircraft Corporation

Normal land impact - Landing in the vicinity of the launching pad at Cape Canaveral. This local terrain shall be studied so that the soil characteristics used in landing calculations will represent conservative values for a large percentage of the possibilities. Wind drift and parachute swing angles used will be based on probability studies.

APPENDIX I-A

GOVERNMENT-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

Item	Qty.	Nomenclature	Weight
*1	-	Survival Equipment as Follows: (See Paragraph 3.17.4)	
1.1	1	One-Man Life Raft	
1.2	1	Chemical Desalting Kit (for 8 pints)	
1.3	1	Shark Chaser Packet	
1.4	3	Dye Marker Packets	
1.5	1	Battery-Powered Survival Light (ACR-4-E or equivalent)	
1.6	1	Signal Mirror	
1.7	1	First Aid Kit Consisting of:	
1.7.1	As Req.	Gauze Compress	
1.7.2	As Req.	Gauze Bandage	
1.7.3	15	Oxytetracycline Tablets (4 grains each)	
1.7.4	6	Motion-Sickness Tablets (Meclizine - 3/8 grain each)	
1.7.5	As Req.	Muslin Bandage	
1.7.6	1	Small Cake of Soap	
1.7.7	1	Tube of Zinc Oxide Ointment (Approx. 2-1/2 oz.)	
1.8	1	Signal Whistle	
1.9	1	Small Can Survival Rations	
1.10	18	Full-Size Waterproof Matches in Waterproof Metal Container (Additional match heads shall be contained in the survival knife handle)	
1.11	10 ft.	Multibraided Nylon Line (Fish hooks shall be contained in survival knife handle)	
1.12	1	Small Pocket Knife	
1.13	1	SARAH Radio Beacon with Antenna and Battery (Ultra RB-5 and RB-7)	
1.14	1	Sunglasses	
2	-	Food, Low Residue	1.70
3	4	Film Pack, Cosmic Ray (See Paragraph 3.15.3)	.30

* The Survival Kit shall be packed by the contractor and shipped to the launch site for installation in the capsule.

APPENDIX I-A - (Continued)

GOVERNMENT-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

Item	Qty.	Nomenclature	Weight
4	-	Connectors, Pressure Suit, Consisting of:	
4.1	1	Suit Inlet Hose	.70
4.2	1	Suit Outlet Hose	1.10
4.3	2	Instrumentation Patch, 16-Terminal (1 Inside, 1 Outside)	.08
5	1	Face Piece Seal Bottle, B. F. Goodrich P/N 3F1056, Including:	
5.1	-	1 - Bottle	
5.2	-	1 - Reducer	
5.3	-	1 - Hose	
6	1	Flashlight with Batteries Size C Cell (See Paragraph 3.8.5.2)	
7	1	Knife, Survival (See Paragraph 3.8.5.1)	
8	1	Container, Food, 2" X 5" X 6" Max. (Army Quartermaster Corps. per Drawing No. 45-019717)	
9	1	Antenna Assembly, Communications 45-31003-305 (MRR5LAE9)	

APPENDIX I-B

GOVERNMENT-FURNISHED EQUIPMENT - GOVERNMENT INSTALLED

Item	Qty.	Nomenclature
1	3	Injectors (See Paragraph 3.17.4)

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
1		General Assembly, Mercury, Including:	45-00001-45	-
1.1	1	Pylon Assembly, Escape	45-31001-315	-
1.2	1	Capsule Assembly	45-32000-313	-
1.2.1	1	Structural Assembly, Capsule	45-32001-303	-
1.2.1.1	1	Structural Assembly Conical Section	45-32002-303	-
1.2.1.1.1	1	Window Assembly, Capsule Inner (Forward Viewing)	45-35035-301	-
1.2.1.1.2	1	Shield, Bulkhead Fiber-glas	45-32290-311	-
1.2.1.2	1	Structural Assembly, Cylindrical Section	45-32003-301	-
1.2.2	1	Shingle Installation, Capsule	45-32245-301	-
1.2.3	1	Insulation Installation	45-32038-307	-
1.2.4	1	Door Assembly	45-32091-303	-
1.2.5	1	Window Assembly, Capsule Outer	45-35030-1	-

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
1.2.6	1	Impact Cushion Installation, Including:	45-32300-311	-
1.2.6.1	1	Heat Shield Assembly	45-32052-327	-
1.2.6.2	2	Valve Jettison (0.55 to 0.80 OHMS)	45-61700-482	Bell: 8060-472-091-3
1.2.7	24	Cable Assembly, Capsule to Heat Shield	45-32353-301	-
1.2.8	1	Impact Skirt	45-32700-3	-
1.2.9	1	Hatch Installation	45-35003-1	-
1.2.10	1	Seal Assembly	45-35005-1	-
1.2.11	1	Link Assembly	45-81045-301	-
1.3	1	Structural Assembly, Atlas Adapter	45-33002-309	-
1.4	1	System Installation, Recovery (See Item 10)	45-41001-316	-
1.5	1	Rocket Installation Retrograde (See Item 2)	45-50001-319	-
1.5.1	3	Strap Assembly	45-72030-303	-
1.5.2	1	Structural Assembly	45-50002-303	-
1.6	1	Rocket Installation, Safety (See Item 2)	45-51001-307	-

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
1.6.1	1	Escape Rocket Structural Assembly	45-51002-309	-
1.6.1.1	1	Ballast Assembly	45-51010-301	-
1.6.1.2	1	Spike Assembly, Ballasted Aerodynamic	45-51017-1	-
1.7	1	System Installation, Manual Controls	45-61001-311	-
1.7.1	1	H_2O_2 System Installation	45-61075-311	-
1.8	1	System Installation, Reaction Controls (See Item 6)	45-62001-37	-
1.8.1	1	Pressurization Installation, Reaction Controls, Manual and Automatic	45-62010-321	-
1.8.2	1	Fuel Installation, Reaction Control	45-62040-33	-
1.8.3	1	Fuel Installation, Reaction Control	45-62040-35	-
1.8.4	1	Installation, Min. "K" Insulation, Reaction Controls	45-62049-305	-
1.8.5	1	Installation, Min. "K" Insulation, Reaction Controls	45-62049-315	-
1.8.6	1	Lines Installation, Vent	45-62075-1	-

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
1.9	1	System Installation, Pyrotechnics (See Item 11)	45-72001-16	-
1.9.1	1	Installation Conical Fairing Pylon to Capsule	45-72045-1	-
1.9.1.1	1	Fairing Assembly, Pylon to Capsule, Conical	45-72043-1	-
1.9.2	1	Clamp Ring, Capsule - Adapter	45-72100-3	-
1.9.3	1	Installation, Antenna Fairing Ejector	45-72020-303	-
1.9.4	1	Installation, Retaining Ring, Pylon to Capsule	45-72045-1	-
1.9.5	1	Installation, Emergency Controls (Manual)	45-72050-309	-
1.10	1	Electrical Installation, Escape Rocket	45-77000-1	-
1.11	1	Electrical Installation, Pylon	45-77001-301	-
1.12	1	Electrical Installation, Antenna Fairing	45-77002-309	-
1.13	1	Electrical Installation, Midsection	45-78003-317	-
1.14	1	Electrical Installation, Ablation Shield	45-78001-307	-

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
1.15	1	Electrical Installation, Retrorocket	45-78002-325	-
1.16	1	Electrical Installation, Adapter - Atlas	45-79001-307	-
1.17	1	Equipment Installation (See Items 3, 4, 5, 6, 7, 8 and 9)	45-80016-1	-
1.17.1	1	Equipment Installation, R.H. Console	45-81002-329	-
1.17.2	1	Main Instrument Panel	45-81100-319	-
1.17.3	1	Panel Assembly, L.H. Console	45-81110-323	-
1.17.4	1	Installation, Window Pole and Flashlight	45-81098-301	-
1.17.5	1	Cover and Filter Assembly, Window	45-86005-301	-
1.17.5.1	1	Cover Assembly	45-86006-1	-
1.17.5.2	1	Cover Assembly	45-86006-2	-
1.17.5.3	1	Filter Assembly, Forward Looking Window	45-86007-1	-
1.17.5.4	1	Filter Assembly, Forward Looking Window	45-86007-2	-
1.17.5.5	1	Mirror Assembly, Extended Viewing	45-86028-1	-

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
1.17.6	1	Installation, Face Lens Seal Bottle	45-82070-1	-
1.17.7	1	Installation, Astronaut's Knife	45-81102-1	-
1.17.8	1	Kit Assembly, Survival	45-81029-315	-
1.17.9	1	Astronaut Waste Container	45-81230-301	-
1.17.10	1	Installation, Harness Reel and Release Linkage	45-82013-309	-
1.17.11	1	Navigational Aid Kit	45-81089-1	-
1.17.12	1	Binder Assembly, Navigational Aid Kit	45-81087-303	-
1.17.13	1	Installation, Inverter Cooling Duct	45-83144-1	-
1.17.14	2	Crushable Support Assembly, Pilot Seat	45-82001-301-xx*	-
1.17.15	2	Crushable Support Assembly, Pilot Seat	45-82057-301-xx*	-
1.17.16	1	Equipment Installation, Coolant Quantity Indicating System	45-83007-313	-

* These items to be shipped to launch site for installation

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
1.17.17	1	Installation, Inverter Cooling	45-83135-303	-
1.17.18	1	Installation, Coolant Lines	45-83006-313	-

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL - (Continued)

Item	Astronaut	Seat Inst. Astronaut 45-82003*	R.H. Arm Rest 45-82003*	L.H. Arm Rest 45-82003*	Seat Ass'y. Astronaut Contoured 45-82000*	Head Ass'y. 45-82000*	Back Ass'y. 45-82000*	Leg Restraint Ass'y. 45-82002*
1.17.19	Carpenter	-1	-33	-17	-1	-17	-33	-1
1.17.20	Cooper	-3	-35	-19	-3	-19	-35	-19
1.17.21	Glenn	-5	-37	-21	-5	-21	-37	-21
1.17.22	Grissom	-7	-39	-23	-7	-23	-39	-23
1.17.23	Schirra	-9	-41	-25	-9	-25	-41	-25
1.17.24	Shepard	-11	-43	-27	-11	-27	-43	-27
1.17.25	Slayton	-13	-45	-29	-13	-29	-45	-29

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ROCKET INSTALLATIONS

			IDENTIFICATION	
Item	Qty.	Nomenclature	M.A.C. No.	Mfg. No.
2		Capsule Rocket Installations	-	-
2.1	3*	Rocket Assembly, Retrograde, Consisting of:	45-50700-31	Thiokol: TE-316-31
2.1.1	1	Rocket, Retrograde	45-50700-3	Thiokol: TE-316-3
2.1.1.1	1	Pressure Switch	-	-
2.1.2	1	Heater Assembly	45-50702-17	COX: 6005-17
2.1.3	1	Heater	45-50702-19	COX: 6005-19
2.1.4	1	Temperature Control Unit	45-50702-13	-
2.2	3	Rocket, Posigrade	45-50701-3	Atlantic Research: D20763
2.3	1	Rocket, Escape System	45-51700-3	Grand-Central: 477-80100-3
2.4	1	Rocket, Pylon Jettison	45-51701-15	Atlantic Research: E22851

* Two of these rocket assemblies are modified in accordance with Drawing No. 45-50030 by addition of 45-88721 resistance elements.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

AIRBORNE EQUIPMENT

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
3		Airborne Equipment, Consisting of:	-	-
3.1	1	Longitudinal Accelerometer (See Paragraph 3.8.9.3)	45-81702-11	Burton: 2026C
3.2	1	Altimeter (Modified by 45-81344)	45-81704-5	Kollsman Instruments: A 33841-10-001
3.3	1	Satellite Clock (See Paragraph 3.8.9.1)	45-81710-9	M.A.C. 45-81120-1
3.4	1	D.C. Voltmeter	45-81716-3	Weston Instrument: 183537
3.5	1	D.C. Ammeter	45-81717-3	Weston Instrument: 183538
3.6	1	A.C. Voltmeter	45-81718-3	Weston Instrument: 183539
3.7	1	Indicator, Auto-Man Fuel	45-81719-9	Weston Instrument: 185377
3.8	1	Transducer (Pitch)	45-81721-5	Minneapolis-Honeywell: GG 134A-8
3.9	1	Transducer (Yaw)	45-81721-9	Minneapolis-Honeywell: GG 134A-9 MRR No: 41AE4G

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

AIRBORNE EQUIPMENT - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
3.10	1	Transducer (Roll)	45-81721-19	Minneapolis-Honeywell: GG 134A-7
3.11	1	Indicator, Angular Rate and Attitude (See Paragraph 3.8.9.2)	45-81721-27	Minneapolis-Honeywell: JG 282A-6
3.12	1	Earth Path Indicator (See Paragraph 3.8.9.5)	45-81722-3	Minneapolis-Honeywell: DJG 280A-1 Series A5
3.13	1	Rate of Descent	45-81723-3	Pioneer-Central: 1652-15A-B15-1
3.14	1	Indicator, Temperature and Pressure	45-81724-5	Weston Instrument: 185916
3.15	1	Indicator, Coolant Quantity	45-83701-5	Weston Instrument:
3.16	1	Indicator, O_2 Partial Pressure	45-83703-7	Weston Instrument: 182495
3.17	1	Indicator, (Dual) O_2 Quantity	45-83706-9	Weston Instrument: 185378
3.18	1	Indicator, Cabin Pressure	45-83707-3	Kollsman Instrument: A 33681-10-001

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

AIRBORNE EQUIPMENT - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
3.19	1	Indicator, Cabin Air Temperature	45-83708-5	Weston Instrument: 183513A
3.20	1	Indicator, Humidity	45-83712-5	Minneapolis-Honeywell: JG 284A-1 Series A5
3.21	1	Periscope (See Paragraph 3.16.1)	45-86701-21	Perkin-Elmer: 539-0109-M1ABCDEFG
3.22	2	Horizon Scanner (See Paragraph 3.10.2)	45-87702-9*	Barnes Engineering: 13-130A-1

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
4		Electrical Equipment, Consisting of:	-	-
4.1	1	Diode Panel Assembly, Power System Control	45-78012-321	-
4.2	1	Relay Panel Assembly, Tone Generator Control	45-78018-1	-
4.3	1	Panel Assembly, Power System Filter	45-78021-303	-
4.4	1	Diode Panel Assembly, Abort Control Circuit	45-78034-301	-
4.5	1	Relay Panel Assembly, Power System Control	45-78081-337	-
4.6	1	Relay Panel Assembly, Power System Control	45-78081-341	-
4.7	1	Relay Panel Assembly, Launch, Orbit and Escape Sequential	45-78084-327	-
4.8	1	Relay Panel Assembly, Launch, Orbit and Escape Sequential	45-78084-365	-
4.9	1	Relay Panel Assembly, Launch, Orbit and Escape Sequential	45-78084-355	-
4.10	1	Relay Panel Assembly, Retrograde Sequential	45-78085-369	-
4.11	1	Relay Panel Assembly, Recovery Sequential	45-78086-397	-

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
4.12	1	Relay Panel Assembly, Clamp Ring Separation	45-78041-307	-
4.13	1	Jumper Plug Assembly	45-79025-301	-
4.14	1	Relay Panel Assembly, Camera Control	45-78061-303	-
4.15	1	Panel Assembly, Capacitor, Time Delay Relay	45-78054-301	-
4.16	1	Panel Assy., Capacitor Time Delay Relay	45-78054-305	-
4.17	1	Relay Panel Assembly, Recovery Sequential	45-78086-381	-
4.18	1	Zener Diode Panel Assy.	45-78037-303	-
4.19	1	Relay Panel Assembly, Communication and Periscope	45-78089-315	-
4.20	1	Relay Panel Assembly, ASCS System	45-78090-349	-
4.21	1	Relay Panel Assembly, ASCS System	45-78090-359	-
4.22	1	Relay Panel Assembly, Instrumentation Control System	45-78092-311	-
4.23	3	Battery (1500 Watt-Hour)	45-79707-19	Eagle Picher: MAR-4028-B
4.24	3	Battery (3000 Watt-Hour)	45-79707-21	Eagle Picher: MAR-4027-B

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
4.25	2	Static Inverter (250 VA) (Mod. by 45-87046 & 45-87047)	45-79709-9	Interelectronics 28T15A40HA-3
4.26	1	Static Inverter (150 VA) (Mod. by 45-87052)	45-79709-11	Interelectronics 28T15A40GB-3
4.27	2	Filter Assembly	45-79709-7	Interelectronics 28FA30GHA-2
4.28	84	Power and Control Relay	45-79712-2	Filtors: P26A1H6A9
4.29	6	Power and Control Relay	45-79712-35	Potter-Brumfield SL4170
4.30	39	Power and Control Relay	45-79712-8	Potter-Brumfield SL4080-1
4.31	4	Power and Control Relay	45-79712-12	Leach: 9227-5369
4.32	1	Power and Control Relay	45-79712-15	Leach: 9226-5368
4.33	7	Power and Control Relay	45-79712-16	Leach: 9224-5367
4.34	15	Power and Control Relay	45-79712-19	Leach: 9229-5371
4.35	13	Power and Control Relay	45-79712-21	Leach: 9220-5366
4.36	5	Power and Control Relay	45-79712-22	Leach: 9228-5370

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL - (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	M.A.C. No.	Mfg. No.
4.37	3	Power and Control Relay	45-79712-23	Leach: 9223-5375
4.38	1	Power and Control Relay	45-79712-26	Leach: 9274-5300
4.39	7	Power and Control Relay	45-79712-33	Filtors: 26SR18F
4.40	14	Power and Control Relay	45-79712-34	Filtors: LL26E18J
4.41	2	Power and Control Relay	45-79712-32	Leach: 9220-5378
4.42	6	Limit Switch	45-79713-59	Electro-Snap: H11-120
4.43	1	Push Button	45-79713-23	Haydon Switch: 61375
4.44	12	Limit Switch	45-79713-29	Electro-Snap: KX5-4-1
4.45	4	Actuator	45-79713-31	Haydon-Switch C9618-4
4.46	2	Limit Switch	45-79713-61	Electro-Snap: H11-121
4.47	1	Limit Switch	45-79713-81	Electro-Snap: H11-194
4.48	4	Limit Switch	45-79713-65	Electro-Snap: H11-123

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
4.49	2	Limit Switch	45-79713-69	Electro-Snap: H11-125
4.50	4	Limit Switch	45-79713-71	Electro-Snap: H11-127
4.51	4	Limit Switch	45-79713-73	Electro-Snap: H11-128
4.52	8	Push Button	45-79713-79	Haydon Switch: 61615
4.53	7	Relay - Time Delay 2 Seconds	45-79715-1	Wheaton: E371-A
4.54	3	Relay - Time Delay 5 Seconds	45-79715-7	Wheaton: E371-D
4.55	2	Relay - Time Delay 10 Seconds	45-79715-11	Wheaton: E371-E
4.56	1	Relay - Time Delay 15 Seconds	45-79715-13	Wheaton: E371-F
4.57	1	Relay - Time Delay 20 Seconds	45-79715-15	Wheaton: E371-H
4.58	1	Relay - Time Delay 30 Seconds	45-79715-17	Wheaton: E371-H
4.59	1	Relay - Time Delay 300 Seconds	45-79715-67	Wheaton: E376-A
4.60	1	Relay - Time Delay 23 Seconds	45-79715-71	Wheaton: E372-N

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
4.61	2	Relay - Time Delay 30 Seconds	45-79715-37	Wheaton: E372-E
4.62	2	Relay - Time Delay 60 Seconds	45-79715-39	Wheaton: E372-F
4.63	1	Relay - Time Delay 150 Seconds	45-79715-43	Wheaton: E375-D
4.64	2	Relay - Time Delay 600 Seconds	45-79715-45	Wheaton: E409-A
4.65	2	Relay - Time Delay 5 Seconds	45-79715-51	Wheaton: E372-G
4.66	2	Relay - Time Delay 10 Seconds	45-79715-53	Wheaton: E372-H
4.67	3	Relay - Time Delay 1 Second	45-79715-55	Wheaton: E372-J
4.68	5	Relay - Time Delay 12 Seconds	45-79715-57	Wheaton: E372-K
4.69	2	Relay - Time Delay	45-79715-61	Wheaton: E174
4.70	2	Relay - Time Delay 2 Seconds	45-79715-63	Wheaton: E372-R
4.71	1	Relay - Time Delay 240 and 480 Seconds	45-79715-65	Wheaton: E494-C
4.72	1	Relay - Time Delay 20 Seconds	45-79715-73	Wheaton: E371-P

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
4.73	1	Relay - Time Delay 60 Seconds	45-79715-75	Wheaton: E372-T
4.74	1	Telelight Assembly (TOWER JETT)	45-79720-141	Grimes: 33340-141-327
4.75	1	Telelight Assembly (SEP CAPSULE)	45-79720-145	Grimes: 33340-145-327
4.76	1	Telelight Assembly (RETRO SEQ)	45-79720-149	Grimes: 33340-149-327
4.77	1	Telelight Assembly (RETRO ATT)	45-79720-153	Grimes: 33340-153-327
4.78	1	Telelight Assembly (FIRE RETRO)	45-79720-157	Grimes: 33340-157-327
4.79	1	Telelight Assembly (JETT RETRO)	45-79720-161	Grimes: 33340-161-327
4.80	1	Telelight Assembly (RETRACT SCOPE)	45-79720-165	Grimes: 33340-165-327
4.81	1	Telelight Assembly (.05G)	45-79720-169	Grimes: 33340-169-327
4.82	1	Telelight Assembly (MAIN)	45-79720-173	Grimes: 33340-173-327
4.83	2	Telelight Assembly (RESCUE)	45-79720-177	Grimes: 33340-177-327
4.84	1	Telelight Assembly (STBY AC-AUTO)	45-79720-185	Grimes: 33340-185-327

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
4.85	1	Telelight Assembly (CABIN PRESS)	45-79720-189	Grimes: 33340-189-327
4.86	1	Telelight Assembly (O_2 QUAN)	45-79720-193	Grimes: 33340-193-327
4.87	1	Telelight Assembly (O_2 EMER)	45-79720-197	Grimes: 33340-197-327
4.88	1	Telelight Assembly (EXCESS SUIT H_2O)	45-79720-209	Grimes: 33340-209-327
4.89	1	Telelight Assembly (EXCESS CABIN H_2O)	45-79720-213	Grimes: 33340-213-327
4.90	1	Telelight Assembly (FUEL QUAN)	45-79720-217	Grimes: 33340-217-327
4.91	1	Telelight Assembly (RETRO WARN)	45-79720-221	Grimes: 33340-221-327
4.92	1	Telelight Assembly (RETRO RESET)	45-79720-225	Grimes: 33340-225-327
4.93	1	Light Assembly (ABORT)	45-79720-237	Grimes: 34160-327-313
4.94	1	Telelight Assembly (LANDING BAG)	45-79720-241	Grimes: 33340-241-327
4.95	8	Solid Conductor	45-78033-3	-
4.96	2	Plug, Tower Elec. Disconnect	45-79722-1	Cannon: 39884-1

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
4.97	2	Receptacle, Tower Elec. Disconnect	45-79722-3	Cannon: 39885-1
4.98	2	Cover, Tower Elec. Disconnect	45-79722-5	Cannon: 39886-1
4.99	1	Receptacle, Umbilical Disconnect Assembly	45-79723-1	Cannon: 17070-799
4.100	130	Fuse (5 Amp)	45-79727-3	Harris: 34020-5
4.101	12	Fuse (10 Amp)	45-79727-11	Harris: 34020-10
4.102	3	Fuse (25 Amp)	45-79727-13	Harris: 34020-25
4.103	21	Fuse Holder Assembly	45-78070-1	-
4.104	21	Fuse Holder Assembly	45-78070-3	-
4.105	9	Fuse Holder Assembly	45-78070-11	-
4.106	31	Switch	45-79729-87	Harris: 34000-9
4.107	2	Switch - 8-Position Rotary	45-79731-1	Harris: 3200-1
4.108	10*	Toggle Switch	45-79732-1	Cutler-Hammer: 8906K983

* 4 of these switches are modified per Drawing No. 45-81299.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
4.109	23	Toggle Switch	45-79732-13	Cutler-Hammer: 8906K984
4.110	1	Toggle Switch	45-79732-15	Cutler-Hammer: 8906K985
4.111	2	Toggle Switch	45-79732-25	Cutler-Hammer: 8906K986
4.112	3	Toggle Switch	45-79732-43	Cutler-Hammer: 8906K1024
4.113	3	Toggle Switch	45-79732-45	Cutler-Hammer: 8906K1023
4.114	3	Toggle Switch	45-79732-49	Micro-Switch: 4TL46-19
4.115	1	Plug Assembly-Antenna	45-79736-1	Cannon: 22037-98
4.116	1	Receptacle Assembly - Antenna	45-79736-3	Cannon: 22037-93
4.117	5	Plug Assembly - Retrograde and Adapter	45-79736-9	Cannon: 22037-90
4.118	5	Receptacle Assembly - Retrograde and Adapter	45-79736-11	Cannon: 22037-91
4.119	1	Floodlight	45-79738-3	Grimes: 43315-A1-5004WW
4.120	1	Modification-Floodlight Offset Handle Including:	45-86040-1	-
4.120.1	1	Floodlight	45-79738-4	Grimes: 43315-A2-5004WW

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
4.121	1	Panel Assembly, L.H. Switch	45-81014-325	-
4.121.1	1	Switch Assembly	45-81358-1	-
4.122	1	Flashing Recovery Light	45-86702-3	ACR Electronics: ACR 113-M
4.123	1	Maximum Altitude Sensor	45-87708-9	Donner - Scientific: 7005C
4.124	1	Thrust Cutoff Sensor	45-87709-5	Donner - Scientific: 4403-2-300-020
4.125	1	Instrument Assembly, E.C.S. Thermo Switch	45-88108-1	-
4.126	1	Instrument Assembly, E.C.S. Thermo Switch	45-88108-3	-
4.127	1	Floodlight	45-79738-5	Grimes: 150012-5
4.128	1	Floodlight	45-79738-6	Grimes: 150012-6
4.129	1	Panel Assembly Microphone Resistor	45-78069-1	-
4.130	1	Panel Assembly, Relay	45-78065-1	-
4.131	1	Panel Assembly, Aux. Battery	45-78067-1	-

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL - (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	M.A.C. No.	Mfg. No.
4.132	1	Filter Assembly, Scanner	45-78068-1	-
4.133	1	Filter Assembly, Scanner	45-78068-301	-
4.134	2	Heater-Horizon Scanner	45-78071-1*	-
4.135	1	Panel Assembly, Relay	45-78072-1	-

* This item to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

AUTOMATIC STABILIZATION AND CONTROL SYSTEM

			IDENTIFICATION	
Item	Qty.	Nomenclature	M.A.C. No.	Minneapolis-Honeywell No.
5	1	Automatic Stabilization and Control System, Consisting of:	45-87700-315	-
5.1	1	Attitude Gyro (Vertical)	45-87700-3	GG53E-3
5.2	1	Attitude Gyro (Directional)	45-87700-5	GG53E-4
5.3	1	Rate Gyro (Pitch)	45-87700-7	GG79A-10
5.4	1	Rate Gyro (Roll)	45-87700-9	GG79A-11
5.5	1	Rate Gyro (Yaw)	45-87700-11	GG79A-12
5.6	1	Acceleration Switch	45-87700-15	GG118A-1
5.7	1	Rate Damper	45-87700-27	BG171A-3
5.8	1	Calibrator	45-87700-35	BG161A-9

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

REACTION CONTROL SYSTEM

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
6	1	Reaction Control System, Consisting of:	45-61700-44	Bell Aircraft
6.1	5	Valve, Check (5/16)	45-61700-51	8060-472-035-1
6.2	3	Tee Similar to (AN 824-4D)	45-61700-54	8060-475-021-4
6.3	5	Union Similar to (AN 815-4D)	45-61700-56	8060-475-022-4
6.4	6	Union Similar to (AN 815-5D)	45-61700-57	8060-475-022-5
6.5	1	Union Similar to (AN 815-6D)	45-61700-58	8060-475-022-6
6.6	1	Assembly, Solenoid 1 and 6 Lb.	45-62060-19	-
6.7	1	Assembly, Solenoid, 1 and 6 Lb.	45-62060-20	-
6.8	4	Assembly, Solenoid, 24 Lb.	45-62064-1	-
6.9	3	Assembly, Solenoid 24 Lb.	45-62064-3	-
6.10	1	Assembly, Solenoid 24 Lb.	45-62064-5	-
6.11	4	Assembly, Solenoid 1 Lb.	45-62064-7	-

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

REACTION CONTROL SYSTEM - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
6.12	1	Assembly, Solenoid, 1 Lb.	45-62064-11	-
6.13	1	Tee (Similar to MS24395D4)	45-61700-425	-
6.14	1	Tee (Similar to MS24390D4)	45-61700-427	-
6.15	2	Valve Jettison (0.55 to 0.80 OHMS)	45-61700-482	8060-472-094-3
6.16	2	Bottle (Helium)	45-61700-483	8060-471-002-3
6.17	1	Transducer	45-61700-1417	8060-472-014-5
6.18	1	Transducer	45-61700-1418	8060-472-014-7
6.19	2	Valve, Manual, Shutoff Low	45-61700-495	8060-472-009-3
6.20	1	Tee (Similar to AN 834-6D)	45-61700-1021	8060-475-019-6
6.21	1	45° Elbow (Similar to AN 837-6D)	45-61700-1022	8060-475-024-6
6.22	1	90° Elbow (Similar to AN 821-6D)	45-61700-1023	8060-475-025-6
6.23	1	Valve Assembly, Selector, H_2O_2	45-62066-1	-
6.24	3	Valve Assembly, Shut-Off, H_2O_2	45-62067-1	-

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

REACTION CONTROL SYSTEM - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
6.25	1	Tank Assy., Automatic	45-61700-1055	8060-471-001-11
6.26	1	Tank Assy., Manual	45-61700-1057	8060-471-010-11
6.27	2	Valve, Relief (3/8")	45-61700-1079	8060-472-122-9
6.28	4	T/C Assy., Pitch and Yaw, 4-24 Lb., Manual	45-61700-1155	8060-470-133-5
6.29	4	T/C Assy., Pitch and Yaw, 24 Lb., Automatic	45-61700-1139	8060-470-112-49
6.30	1	T/C Assy., Roll, Lower, 1-6 Lb., Manual	45-61700-1157	8060-470-134-5
6.31	1	T/C Assy., Roll, Upper, 1-6 Lb., Manual	45-61700-1158	8060-470-134-6
6.32	1	T/C Assy., Roll, Lower, 1 and 6 Lb., Automatic	45-61700-1141	8060-470-114-25
6.33	1	T/C Assy., Roll, Upper, 1 and 6 Lb., Automatic	45-61700-1142	8060-470-114-26
6.34	4	T/C Assy., Pitch and Yaw, 1 Lb., Automatic	45-61700-1143	8060-470-113-33
6.35	2	Shutoff Valve, Manual Fill Vent	45-61700-1175	G.W. Dahl Co. A1228B
6.36	1	Valve Throttle, 1-6 Lb. (1/4")	45-61700-1171	8060-472-038-131
6.37	2	Valve, Throttle, 4-24 Lb.	45-61700-1172	8060-472-039-91
6.38	1	Valve, Manual Shutoff	45-61700-1409	8060-472-094-1

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

REACTION CONTROL SYSTEM - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
6.39	1	Valve, Manual Shutoff (Regulator)	45-61700-1411	8060-472-094-3
6.40	2	Valve, Manual Shutoff (Helium Fill)	45-61700-1415	8060-472-001-11
6.41	2	Valve Relief	45-61700-1425	8060-472-107-9
6.42	2	Filter	45-61700-1427	8060-472-004-3
6.43	2	Regulator Assembly	45-61700-1431	8060-472-120-3
6.44	1	Tube Assembly	45-62022-2	-
6.45	1	Tube Assembly	45-62022-3	-
6.46	1	Tube Assembly	45-62022-4	-
6.47	1	Tube Assembly	45-62022-5	-
6.48	1	Tube Assembly	45-62022-6	-
6.49	1	Tube Assembly	45-62022-7	-
6.50	1	Tube Assembly	45-62022-13	-
6.51	4	Tube Assembly	45-62022-18	-
6.52	1	Tube Assembly	45-62022-71	-
6.53	1	Tube Assembly	45-62022-15	-
6.54	1	Tube Assembly	45-62022-16	-
6.55	1	Tube Assembly	45-62022-63	-

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

REACTION CONTROL SYSTEM - (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	M.A.C. No.	Mfg. No.
6.56	1	Tube Assembly	45-62022-19	-
6.57	1	Tube Assembly	45-62022-20	-
6.58	1	Tube Assembly	45-62022-21	-
6.59	1	Tube Assembly	45-62022-22	-
6.60	1	Tube Assembly	45-62022-23	-
6.61	1	Tube Assembly	45-62022-24	-
6.62	1	Tube Assembly	45-62022-83	-
6.63	1	Tube Assembly	45-62022-27	-
6.64	1	Tube Assembly	45-62022-28	-
6.65	1	Tube Assembly	45-62022-29	-
6.66	1	Tube Assembly	45-62022-68	-
6.67	1	Tube Assembly	45-62022-31	-
6.68	1	Tube Assembly	45-62022-60	-
6.69	1	Tube Assembly	45-62022-62	-
6.70	2	Tube Assembly	45-62022-34	-
6.71	1	Tube Assembly	45-62022-35	-
6.72	1	Tube Assembly	45-62022-36	-
6.73	1	Tube Assembly	45-62022-37	-

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

REACTION CONTROL SYSTEM - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	Mfg. No.
6.74	1	Tube Assembly	45-62022-38	-
6.75	1	Tube Assembly	45-62022-39	-
6.76	1	Tube Assembly	45-62022-40	-
6.77	1	Tube Assembly	45-62022-41	-
6.78	1	Tube Assembly	45-62022-43	-
6.79	1	Tube Assembly	45-62022-45	-
6.80	1	Tube Assembly	45-62022-46	-
6.81	1	Tube Assembly	45-62022-47	-
6.82	1	Tube Assembly	45-62022-80	-
6.83	1	Tube Assembly	45-62022-81	-
6.84	1	Tube Assembly	45-62022-50	-
6.85	1	Tube Assembly	45-62022-51	-
6.86	4	Tube Assembly	45-62022-52	-
6.87	1	Tube Assembly	45-62022-65	-
6.88	1	Tube Assembly	45-62022-66	-
6.89	1	Tube Assembly	45-62022-55	-
6.90	1	Tube Assembly	45-62022-56	-
6.91	1	Tube Assembly	45-62022-70	-

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

REACTION CONTROL SYSTEM - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
6.92	1	Tube Assembly	45-62022-67	-
6.93	1	Tube Assembly	45-62022-59	-
6.94	1	Tube Assembly	45-62022-61	-
6.95	1	Tube Assembly	45-62022-10	-
6.96	1	Tube Assembly	45-62022-11	-
6.97	1	Tube Assembly	45-62022-82	-
6.98	2	Valve, Check - (6-1 Lb.)	45-61700-1151	Spartan Aircraft: C107-4-8C25
6.99	4	Valve, Check - (24-4 Lb.)	45-61700-1153	Spartan Aircraft: C107-5-6C25
6.100	2	Valve, Check	45-61700-417	8060-472-010-1
6.101	2	Tee (Similar to MS24402D4)	45-61700-421	8060-475-026-4
6.102	2	Elbow (Similar to MS24394D4)	45-61700-423	8060-475-028-4

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

COMMUNICATION SYSTEM

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
7		Communications System Consisting of:	45-85700-351	Collins
7.1	1	Transmitter-Receiver, HF Voice (Mod. By 45-85017)	45-85700-3	Collins: 522 1793 035
7.2	1	Transmitter-Receiver, HF Rescue-Voice (Mod. By 45-85018)	45-85700-5	Collins: 522 1794 035
7.3	1	Panel, Control (Mod. By 45-85014)	45-85700-31	Collins: 522 1812 034
7.4	3	Antenna, S and C-Band	45-85700-33	Melpar: R436158-1A
7.5	1	Power Divider, C-Band (Mod. By 45-85038)	45-85700-35	Melpar: R530310-1A
7.6	1	Isolator, Bicone	45-85700-43	Collins: 522 1963 012
7.7	1	Antenna, UHF Descent	45-85700-49	Collins: 522 1817 015
7.8	2	Switch Coaxial (Mod. By 45-85030 and 45-85031)	45-85700-51	Transco: 1460 233B
7.9	1	Diplexer, HF (Mod. By 45-85032)	45-85700-57	Collins: 522 1813 014
7.10	1	Amplifier, UHF Voice Power	45-85700-61	Collins: 522 1989 015

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

COMMUNICATION SYSTEM - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
7.11	2	Transmitter-Receiver, UHF Voice (Mod. By 45-85019 and 45-85020)	45-85700-63	Collins: 522 1851 025
7.12	1	Audio Center	45-85700-65	Andrea: AC 75E
7.13	1	Multiplexer (Mod. By 45-85029)	45-85700-71	Microphase: 7M769B-2
7.14	1	Power Divider, S-Band	45-85700-73	Melpar: R530311-1B
7.15	1	Beacon, HF/UHF Rescue	45-85700-75	Simmonds Aero: 311006B
7.16	1	Transmitter, Telemetry - Low Freq.	45-85700-101	Texas Instrument: 433992-1-A6
7.17	1	Transmitter, Telemetry - High Freq.	45-85700-79	Texas Instrument: 433992-2-B6
7.18	1	Auxiliary UHF Rescue Beacon	45-85700-85	Simmonds Aero: 311016
7.19	1	Matching Network HF Whip	45-85700-89	Collins: 522 2362 004
7.20	1	Beacon, C-Band Radar (Mod. By 45-85026)	45-85700-109*	Avion: 152A 400-2
7.21	1	Beacon, S-Band Radar (Mod. By 45-85027)	45-85700-111*	Avion: 152A 900-4

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

COMMUNICATION SYSTEM - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
7.22	2	Receiver, Command (Mod. By 45-85022 and 45-85023)	45-85700-95	Motorola: 201 313 00F
7.23	2	Decoder, Command (Mod. By 45-85022 and 45-85023)	45-85700-97	Motorola: 201 312 98D
7.24	2	Power Supply, Telemetry	45-85700-99	Texas Instrument: 433993-1-3 Mod. 1
7.25	1	Antenna Assembly, Aux. UHF Rescue Beacon	45-41022-1	-
7.26	1	Antenna, HF Rescue, 16 Ft.	45-41024-1	Raymond Eng. Lab.: 1529B-17
7.27	1	Line Filter, Telemetry (Mod. By 45-85016)	45-85700-83	Collins: 522 2362 004

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION AiResearch No.
8	1	Environmental Control System Consisting of:	45-83700	-
8.1	1	Regulator, Suit Pressure	45-83700-753	132190-4
8.2	1	Trap, Solids	45-83700-43	174310
8.3	2	Blower, Suit Circuit (Mod. By 45-83122 and 45-83128)	45-83700-49	207970
8.4	1	Valve, Oxygen Check (Mod. By 45-83129)	45-83700-53	123104-1
8.5	1	Absorber, Suit Circuit Water (Mod. By 45-83097)	45-83700-729	175830-3
8.6	1	Tank, Cooling Water (Mod. By 45-83090)	45-83700-61	175320-1
8.7	1	Controls, Box (Mod. By 45-83095)	45-83700-65	510352
8.8	2	Coupling, Water	-	Airaterra 4710J4A
8.9	4	Valve, Oxygen Check	45-83700-53	123104-1
8.10	1	Valve, Post-Landing Outflow (Mod. By 45-83075)	45-83700-735	122216-100
8.11	1	Valve, Ground Oxygen Inlet	45-83700-81	PS 137205
8.12	1	Valve, Suit Pressure Relief	45-83700-87	130100

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM - (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	M.A.C. No.	AiResearch No.
8.13	1	Orifice, Flow Limiting	45-83700-89	PS 174411
8.14	1	Installation, Suit O_2 Sampling	45-83131-1	-
8.15	1	Valve, Snorkel Outflow	45-83121-1	-
8.16	1	Valve, Solenoid-Switch (Mod. By 45-83166)	45-83700-105	319190-2
8.17	1	Manifold, Suit Inlet	45-83700-175	174253
8.18	1	Duct, Cabin Evaporator Steam	45-83700-177	174363
8.19	1	Manifold, Compressor Outlet	45-83700-179	174479
8.20	1	Fitting, Suit Pressure Regulator Outlet	45-83700-181	174295
8.21	1	Duct, Water Separator Exit	45-83700-183	174364
8.22	1	Manifold, Compressor Inlet	45-83700-187	175767
8.23	1	Valve, Ground Ventilation Inlet	45-83700-785	122366-200
8.24	1	Bracket, Cabin Pressure Control Valve	45-83700-193	174693
8.25	1	Valve, Snorkel Inflow (Mod. By 45-83103)	45-83700-211	121074-1

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM - (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	M.A.C. No.	AiResearch No.
8.26	1	Oxygen Lines Connecting Tube from Tee @ RX12.00 to Tee Connecting with Secondary O_2 System	45-83700-213	174535
8.27	1	Oxygen Lines from Tee @ Secondary O_2 Line to LX12.00 Tee	45-83700-215	174537
8.28	1	Oxygen Lines from Tee on LX12.00 to O_2 Reducer	45-83700-221	174558
8.29	1	Oxygen Lines from O_2 Reducer to Water Separator Solenoid Inlet	45-83700-223	174559
8.30	1	Oxygen Lines from Water Separator Solenoid Outlet to H_2O Separator Inlet	45-83700-225	174685
8.31	1	Oxygen Lines from Tee on RX12.00 to Tee on O_2 Rate Valve Inlet	45-83700-227	174528
8.32	1	Oxygen Lines from Tee on O_2 Rate Valve Inlet to O_2 Demand Regulator	45-83700-229	174523
8.33	4	Valve, Freon 114 Check	45-83700-771	-
8.34	2	Gasket, Suit Heat Exchanger	45-83700-237	174247
8.35	1	Oxygen Lines from Comp. Pressure Switch to Reducer on Comp. Pressure Switch	45-83700-239	174518

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM - (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	M.A.C. No.	AiResearch No.
8.36	1	Water Lines from Water Fill on Tank to H_2O Fill Valve	45-83700-241	174513
8.37	1	Water Lines from H_2O Vent Valves	45-83700-243	174514
8.38	1	Water Lines from H_2O Tank Outlet to Union on RX12.00	45-83700-245	174515
8.39	1	2.5 Inch Marman Clamp	45-83700-255	4266
8.40	6	2.31 Inch Marman Clamp	45-83700-257	4365
8.41	1	2.68 Inch Marman Clamp	45-83700-259	4365
8.42	5	2.75 Inch Marman Clamp	45-83700-261	4365
8.43	6	"O"-Ring for Marman Clamp 4365-231	45-83700-265	S8057BE-265
8.44	1	"O"-Ring for Marman Clamp 4365-268	45-83700-267	S8057BE-245
8.45	10	"O"-Ring for Marman Clamp 4365-275	45-83700-269	S8057BE-208
8.46	1	"O"-Ring CO_2 Absorber and Evaporator	45-83700-271	S8057BE-268
8.47	3	"O"-Ring System Shutoff Valves 122294 and Duct 174295	45-83700-273	S8469G-141
8.48	21	"O"-Ring	45-83700-277	S8469G-121

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION AiResearch No.
8.49	4	"O"-Ring for Boss on Compressor Inlet Duct	45-83700-279	S8469G-5
8.50	1	Union, Bulkhead	45-83700-281	AN832-4D
8.51	4	Tee-Bulkhead on Run	45-83700-283	AN804-4D
8.52	3	Union	45-83700-285	AN815-4D
8.53	3	Reducer	45-83700-287	AN919-1D
8.54	1	Tee	45-83700-291	AN824-4D
8.55	1	Plug	45-83700-293	AN814-4D
8.56	2	45° Elbow-Flared Tube	45-83700-295	AN837-4D
8.57	1	O_2 Line from 45° Elbow on RX12.00 to Suit Inlet Elbow	45-83700-403	175339
8.58	1	90° Elbow	45-83700-409	-
8.59	1	CO_2 Absorber and Odor Control Suit	45-83700-417	176080-1
8.60	1	Valve, Pressure Test (Mod. By 45-83098)	45-83700-419	130098-2
8.61	1	Sensor, Blower Pressure Differential	45-83700-421	PS 207272-1
8.62	1	Blower, Cabin Equipment (Mod. By 45-83165)	45-83700-425	207990

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION AiResearch No.
8.63	1	Assembly, Primary Oxygen Bottle, (Mod. By 45-83091) Consisting of:	45-83700-431	134292-1
8.63.1	1	Valve, Oxygen Shutoff	45-83700-23	132180
8.63.2	1	Coupling, Oxygen Bottle Filler	-	Tavco: 268421-1
8.63.3	1	Tee Fitting, Hi-Pressure	45-83700-109	137455
8.63.4	1	Cap	45-83700-123	MS21914-2
8.63.5	1	Elbow	45-83700-127	MS21908-4C
8.63.6	2	Nut	45-83700-129	S8079-229
8.63.7	1	Packing	45-83700-131	S8469M111
8.63.8	4	Packing	45-83700-133	S8469M121
8.63.9	AS/R	Locknut Wire	45-83700-135	MS20995C20
8.63.10	2	Retainer	45-83700-195	137529-1
8.63.11	1	Bottle, Oxygen	45-83700-427	134340-1
8.64	1	Assembly, Secondary Oxygen Bottle, (Mod. By 45-83091) Consisting of:	45-83700-435	134300-1
8.64.1	1	Valve, Oxygen Shutoff	45-83700-23	132180
8.64.2	1	Coupling, Oxygen Bottle Filler	-	Tavco: 268421-1
8.64.3	1	Tee-Fitting, Hi-Pressure	45-83700-109	137455
8.64.4	1	Cap	45-83700-123	MS21914-2

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM - (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	M.A.C. No.	AiResearch No.
8.64.5	1	Elbow	45-83700-127	MS21908-4C
8.64.6	2	Nut	45-83700-129	S8079-229
8.64.7	1	Packing	45-83700-131	S8469M111
8.64.8	4	Packing	45-83700-133	S8469M121
8.64.9	AS/R	Locknut Wire	45-83700-135	MS20995C20
8.64.10	2	Retainer	45-83700-195	137529-1
8.66.11	1	Bottle, Oxygen	45-83700-427	134340-1
8.65	1	Manifold, Solids Trap Exit	45-83700-437	173905
8.66	1	Duct, Ground Vent Inflow	45-83700-443	175212
8.67	1	Valve, System Shutoff	45-83700-741	122260-2
8.68	1	Oxygen Lines from Primary Oxygen Bottle to Manifold Inlet	45-83700-457	175596
8.69	1	Oxygen Lines from Primary Oxygen Bottle to O_2 Pressure Transducer	45-83700-459	174317
8.70	1	Oxygen Lines from Secondary O_2 Bottle to Manifold Inlet	45-83700-461	175598
8.71	1	Oxygen Lines from Secondary O_2 Bottle Cross to Pressure Transducer	45-83700-463	174319

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM - (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	M.A.C. No.	AiResearch No.
8.72	2	Clamp Rings, 2.195 to 2.200 Dia.	45-83700-469	175346-1
8.73	1	Clamp Rings, 2.573 to 2.578 Dia.	45-83700-471	175346-2
8.74	5	Clamp Rings, 2.630 to 2.635 Dia.	45-83700-473	175346-3
8.75	1	Freon Orifice for 174250-1	45-83700-475	174906-1
8.76	1	Freon Orifice for 174260-1	45-83700-477	174906-2
8.77	1	Exchanger, Suit Circuit Heat (Mod. By 45-83096)	45-83700-479	174250-3
8.78	1	Exchanger, Cabin Equipment Heat	45-83700-481	174260-3
8.79	1	Valve, Emergency O_2 Rate (Mod. By 45-83126)	45-83700-483	132186-2
8.80	1	Valve, Dual Cabin Pressure Control and Pressurization	45-83700-485	102344-3
8.81	1	"O"-Rings for Plugs at CO_2 Transducer Ports	45-83700-487	3-16
8.82	3	"O"-Rings for Outflow Ports of Cabin Pressure Regulator	45-83700-489	S8469G-6
8.83	2	Valve, Freon 114 Check	45-83700-747	132334-1
8.84	1	Assembly, Primary Oxygen Pressure Regulator, Consisting of:	45-83700-497	132254-2
8.84.1	2	Reducer, Oxygen Pressure	45-83700-27	PS 132184

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM - (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	M.A.C. No.	AiResearch No.
8.84.2	1	Valve, Oxygen Check	45-83700-51	PS 132194
8.84.3	1	Cap	45-83700-123	MS21914-2
8.84.4	1	Cap	45-83700-125	MS21914-4
8.84.5	1	Elbow	45-83700-127	MS21908-4C
8.84.6	2	Nut	45-83700-129	S8079-229
8.84.7	6	Packing	45-83700-133	S8469M121
8.84.8	AS/R	Locknut Wire	45-83700-135	MS20995C20
8.84.9	1	Cap	45-83700-139	AN929-4C
8.84.10	4	Stud, Pressure Reducer Orifice	45-83700-141	137394
8.84.11	4	Washer	45-83700-143	S8157N96-063
8.84.12	4	Nut	45-83700-145	S8079C5R
8.84.13	4	Packing	45-83700-147	S8469M127
8.84.14	4	Ring	45-83700-149	MS28774-10
8.84.15	1	Manifold, Pressure Reducer Outlet	45-83700-151	137454
8.84.16	1	Manifold, Pressure Reducer Inlet	45-83700-153	137453
8.84.17	2	Retainer	45-83700-195	137529-1

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION AiResearch No.
8.85	1	Assembly, Secondary and Purge Oxygen Pressure Regulator, Consisting of:	45-83700-499	132256-2
8.85.1	1	Reducer, Oxygen Pressure	45-83700-29	PS 132184-1
8.85.2	1	Reducer, Oxygen Pressure	45-83700-31	PS 132196
8.85.3	1	Valve Oxygen Check	45-83700-51	PS 132194
8.85.4	2	Cap	45-83700-125	MS21914-4
8.85.5	1	Elbow	45-83700-127	MS21908-4C
8.85.6	2	Nut	45-83700-129	S8079-229
8.85.7	1	Packing	45-83700-131	S8469M111
8.85.8	5	Packing	45-83700-133	S8469M121
8.85.9	AS/R	Locknut Wire	45-83700-135	MS20995C20
8.85.10	1	Cap	45-83700-139	AN929-4C
8.85.11	2	Stud, Pressure Reducer Orifice	45-83700-141	137394
8.85.12	3	Washer	45-83700-143	S8157N96-063
8.85.13	4	Nut	45-83700-145	S8079C5R
8.85.14	3	Packing	45-83700-147	S8469M127
8.85.15	3	Ring	45-83700-149	MS28774-10
8.85.16*	1	Stud, Pressure Reducer Orifice	45-83700-155	137459

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM - (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	M.A.C. No.	AiResearch No.
8.85.17	1	Stud, Pressure Reducer Orifice	45-83700-157	137460
8.85.18	1	Washer	45-83700-159	S8157N238-063
8.85.19	1	Packing	45-83700-161	S8469M6
8.85.20	1	Ring	45-83700-163	MS28774-11
8.85.21	1	Cap	45-83700-165	AN929-6C
8.85.22	1	Support, Pressure Reducer Outlet	45-83700-167	137462
8.85.23	1	Support, Pressure Reducer Inlet	45-83700-169	137461
8.85.24	1	Packing	45-83700-171	S8469M120
8.85.25	1	Elbow	45-83700-173	MS21907-4C
8.85.26	2	Retainer	45-83700-195	137529-1
8.86	6	Screw	45-83700-701	31363-4
8.87	1	Valve, Negative Pressure Relief	45-83700-703	130110-2
8.88	1	"O"-Ring on Boss for Pilot Suit Pressure Relief Valve	45-83700-705	3-8
8.89	2	Valve, Comfort Control	45-83700-711	121078-2
8.90	2	Transducer, O_2 Pressure	45-83700-713	538913
8.91	1	Orifice, Constant Bleed	45-83700-731	131040

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION AiResearch No.
8.92	1	Cabin Pressure Relief Valve (Mod. By 45-83123)	45-83700-745	102416-10
8.93	1	Line Assembly	45-83010-11	-
8.94	1	Line Assembly	45-83010-21	-
8.95	1	Line Assembly	45-83010-25	-
8.96	1	Line Assembly	45-83010-27	-
8.97	1	Line Assembly	45-83010-29	-
8.98	1	Line Assembly	45-83010-115	-
8.99	1	Line Assembly	45-83010-116	-
8.100	1	Line Assembly	45-83010-35	-
8.101	1	Line Assembly	45-83010-37	-
8.102	1	Line Assembly	45-83010-43	-
8.103	2	Line Assembly	45-83010-57	-
8.104	2	Line Assembly	45-83010-61	-
8.105	1	Line Assembly	45-83010-69	-
8.106	1	Line Assembly	45-83010-81	-
8.107	1	Line Assembly	45-83010-82	-
8.108	1	Line Assembly	45-83010-83	-
8.109	1	Line Assembly	45-83010-84	-

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM - (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	M.A.C. No.	AiResearch No.
8.110	1	Line Assembly	45-83010-85	-
8.111	1	Line Assembly	45-83010-86	-
8.112	1	Line Assembly	45-83010-87	-
8.113	1	Line Assembly	45-83010-88	-
8.114	1	Line Assembly	45-83010-89	-
8.115	1	Line Assembly	45-83010-90	-
8.116	1	Line Assembly	45-83010-98	-
8.117	1	Line Assembly	45-83010-99	-
8.118	1	Line Assembly	45-83010-101	-
8.119	1	Line Assembly	45-83010-105	-
8.120	1	Line Assembly	45-83010-106	-
8.121	1	Line Assembly	45-83010-107	-
8.122	1	Line Assembly	45-83010-108	-
8.123	1	Line Assembly	45-83010-109	-
8.124	1	Line Assembly	45-83010-110	-
8.125	1	Line Assembly	45-83010-73	-
8.126	1	Line Assembly	45-83010-76	-
8.127	1	Line Assembly	45-83010-91	-

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT-CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM - (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	M.A.C. No.	AiResearch No.
8.128	1	Line Assembly	45-83010-118	-
8.129	1	Line Assembly	45-83010-119	-
8.130	1	Tank Assembly, Condensate	45-83076-1	-
8.131	1	Line Assembly	45-83010-120	-

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

INSTRUMENTATION

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
9		Instrumentation System, Consisting of:	-	-
9.1	1	Instrumentation Assy, Modified Camera Instrument Observer, Consisting of:	45-88110-1	-
9.1.1	1	Programmer	45-88231-1	-
9.1.2	1	Camera, Instrument, 16 mm Consisting of:	45-88704-7	Milliken: DBM-78
9.1.2.1	1	Lens 10 mm F1.8	-	Bell & Howell "Ingenue"
9.1.2.2	AS/R	Film, 16 mm on Aluminum Reels	-*	Dupont: P931A
9.2	1	Instrumentation Assy, Modified Camera, Pilot Observer, Consisting of:	45-88111-1	-
9.2.1	1	Programmer	45-88232-1	-
9.2.2	1	Camera, Astronaut Observation, 16 mm Consisting of:	45-88704-5	Milliken: DBM-88
9.2.2.1	1	Lens, 10 mm, F1.8	-	Bell & Howell. "Ingenue"
9.2.2.2	AS/R	Film, 16 mm, on Aluminum Reels	-*	-

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

INSTRUMENTATION - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
9.3	1	Instrumentation Assembly Tape Recorder Consisting of:	45-88871-33	-
9.3.1	1	Tape Recorder, Including:	45-88707-303	Consolidated Electrodynamics (CEC) 176217
9.3.1.1	1	Speed Change Kit (1-7/8 ips)	45-88707-13	CEC: 176127
9.3.1.2	1	Transport Assembly	45-88707-15	CEC: 176170
9.3.1.3	2	Reel	45-88707-17*	CEC: 176001
9.3.1.4	3600 Ft.	Tape, 1/2 inch	*	Minn. Mining & Mfg.: 197
9.3.2	1	Direct Record Amplifier Kit	45-88707-7	CEC: 176160
9.4	1	Instrumentation Package "A", consisting of:	45-88100-45	-
9.4.1	1	Assembly, Wired Chassis	45-88100-11	-
9.4.2	1	Power Supply, 3 Volt D.C.	45-88203-15	-
9.4.3	1	Resistance Element, A.C. Power Supply	45-88206-3	-
9.4.4	2	Resistance Element, Amplifier	45-88207-9	-

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

INSTRUMENTATION - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
9.4.5	1	Resistance Element, Amplifier	45-88207-21	-
9.4.6	1	Resistance Element, Amplifier	45-88207-27	-
9.4.7	1	Resistance Element, Amplifier	45-88207-29	-
9.4.8	1	Instrumentation Assembly Mixer Module	45-88237-1	-
9.4.9	1	Amplifier, Body Temperature	45-88215-25	-
9.4.10	1	Amplifier, Body Temperature	45-88215-27	-
9.4.11	2	Commutator, Keyer	45-88728-1 *	General Devices: 1208D-2E
9.4.12	1	Transformer, Filament	-	Comm. Accessories 76-0056-35
9.4.13	1	O_2 Partial Pressure Amp.	45-88221-9	-
9.4.14	1	O_2 Partial Pressure Amp.	45-88221-13	-
9.4.15	1	Instr. Assy., Filter, Noise Amplifier Power	45-88228-1	-

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

INSTRUMENTATION - (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	M.A.C. No.	Mfg. No.
9.5	1	Instrumentation Package "D", Including:	45-88113-1	-
9.5.1	1	Resistor Panel	45-88233-1	-
9.5.2	1	Resistor Panel	45-88233-3	-
9.5.3	1	Resistor Panel	45-88233-5	-
9.5.4	1	Isolation Amplifier	45-88234-3	-
9.5.5	1	Accelerometer Filter	45-88241-13	-
9.5.6	1	Accelerometer "Z" Axis ± 30g	45-88712-3	Donner: 4310-1
9.5.7	2	Accelerometer, "Y" and "X" Axis, ± 4g	45-88712-5	Donner: 4310-2
9.5.8	2	EKG Amplifier	45-88726-1	Thompson - Ramo Woolridge:
9.5.9	2	Diode	-	Texas Instruments: 1N1822
9.5.10	1	Mixer Amplifier	45-88243-21*	Electro-Mechanical Research: (EMR) 206A-20-M10
9.5.11	2	Voltage Controlled Oscillator 0.4KC	45-88243-1*	EMR: 184C-0.40 2.5K-20-M10
9.5.12	2	Voltage Controlled Oscillator 0.56KC	45-88243-3*	EMR: 184C-0.56

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

INSTRUMENTATION - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	Mfg. No.
9.5.13	2	Voltage Controlled Oscillator 0.73KC	45-88243-5*	EMR: 184C-0.73
9.5.14	2	Voltage Controlled Oscillator 1.30KC	45-88243-7*	EMR: 184C-1.30
9.5.15	2	Voltage Controlled Oscillator 1.70KC	45-88243-9*	EMR: 184C-1.70
9.5.16	2	Voltage Controlled Oscillator 2.30KC	45-88243-11*	EMR: 184C-2.30
9.5.17	1	Voltage Controlled Oscillator 3.00KC	45-88243-13*	EMR: 184C-3.00
9.5.18	2	Voltage Controlled Oscillator 3.90KC	45-88243-15*	EMR: 184C-3.90
9.5.19	1	Voltage Controlled Oscillator 5.40KC	45-88243-17*	EMR: 184C-5.40
9.5.20	2	Voltage Controlled Oscillator 10.361KC	45-88243-19*	EMR: 184C-10.361
9.6	1	Instrumentation Package "C", Including:	45-88102-43	-
9.6.1	1	Wired Chassis	45-88102-49	-
9.6.2	1	Solenoid Voltage Attenuator	45-88205-3	-
9.6.3	1	Amplifier, Horizon Scanner	45-88212-11	-

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

INSTRUMENTATION - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	Mfg. No.
9.6.4	1	Amplifier, D.C.	45-88215-29	-
9.6.5	1	Amplifier, D.C.	45-88215-31	-
9.6.6	1	Instrumentation Assy. Solenoid/Rate Signal Mixer	45-88238-5	-
9.6.7	2	Instrumentation Assy. Amplifier Modification	45-88240-1	-
9.6.8	1	Transducer, Cabin Pressure	45-88705-9	CEC: 4-380MUB-15A
9.6.9	1	Instrumentation Assy. Rate Signal Filter and Calibrate Card	45-88214-27	-
9.6.10	1	Instr. Assy., Filter, Noise Amplifier Power	45-88228-3	-
9.7	1	Instrumentation Package "E" Including:	45-88114-1	-
9.7.1	1	Voltage Monitor Card	45-88205-17	-
9.7.2	1	Resistance Element Amplifier	45-88207-23	-
9.7.3	1	Resistance Element Amplifier	45-88207-25	-
9.7.4	1	Vernier Clock Assembly	45-88239-5	-

* These items to be shipped to launch site for installation.

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APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

INSTRUMENTATION - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
9.8	1	Transducer, Suit Pressure	45-88705-9	CEC: 4-380MUB-15A
9.9	2	Transducer, Suit Inlet Air Temperature	-	Ruge: BN-274
9.10	2	Transducer, Ablation Shield Temperature	-	Ruge: 6608
9.11	6	Transducer, Inner Skin Temperature	45-88721-1	Ruge: 3172
9.12	1	Blood Pressure Measuring System	45-88727-1*	Garrett Corp.
9.13	1	Instrumentation Assembly, 8-Day Clock	45-88112-13	-
9.14	1	Transducer, Static Pressure	45-88705-5	CEC: 4-380MUA-15A
9.15	1	Instrumentation Assy., Astronaut Transducer, Consisting of:	45-88822-15*	-
9.15.1	1	Body Temperature Probe	45-88814-11*	Gulton Industries 32PB24B
9.15.2	1	Connector Patch	*	Goodrich: 2P1051
9.15.3	4	EKG Pick-Up	45-88821-11*	-

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

INSTRUMENTATION - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
9.15.4	1	Instrumentation Assy. - Respiration Rate Transducer.	45-88801-123*	-
9.16	1	Pressure Switch	45-88724-11	Carleton Aviation 2800-9
9.17	1	Pressure Switch	45-88724-9	Lourdes Hydraulic L H 10280-2
9.18	4	Transducer, Ablation Shield Temperature	45-88859-3	Ruge: 6608
9.19	1	Instrumentation Assy. Temp. Pickup, Suit Inlet Air	45-88868-13	-
9.20	2	Instrumentation Assy. Resistance Element Temperature Pickup	45-88829-5	-
9.21	1	Temperature Probe	45-88720-3	Transonics, Inc.: 1182B
9.22	1	Programmer	45-88710-7	Wheaton: M-112-7B
9.23	1	Sensor, O_2 Partial Pressure (Mod. By 45-88115)	45-88708-13	Thompson-Ramo-Woolridge
9.24	1	Attenuator	45-88116-1	-
9.25	1	O_2 Flow Sensor, Primary	45-88107-1	-

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

INSTRUMENTATION - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
9.26	1	Transducer, Coolant Quantity Pressure	45-88705-11	Fairchild Controls 947-6018
9.27	1	Instrumentation Kit	45-88999-17*	-
9.28	1	O_2 Flow Sensor, Secondary	45-88107-5	-
9.29	3	Instrumentation Assembly, Potentiometer	45-88893-3	-
9.30	2	Thermocouple Assembly	45-79012-3	-
9.31	2	Thermocouple Assembly	45-79012-23	-
9.32	2	Thermocouple Assembly	45-79012-71	-
9.33	2	Thermocouple Assembly	45-79012-113	-

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

LANDING AND POST-LANDING SYSTEM

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Radioplane No.
10		Landing and Post-Landing System, Consisting of:	45-41700	-
10.1	1	Drogue Chute Assembly, Consisting of:	-	-
10.1.1	1	Drogue Chute	45-41700-29*	R-5103-309
10.1.2	1	Drogue Bag	45-41700-11*	R-5104
10.1.3	1	Chaff Packet	45-41700-133*	101000-3
10.2	1	Mortar Tube	45-41700-145	R-5109-305
10.3	1	Mortar Sabot	45-41700-19*	R-5126
10.4	1	Main Chute System, Consisting of:	-	-
10.4.1	1	Landing Parachute	45-41700-243*	R-5157-327 or 329
10.4.2	1	Bag, Main Chute Deployment	45-41700-221*	R-5116-309
10.4.3	1	Lanyard, Antenna	45-41700-181*	R-5135-311
10.4.4	2	Cutter Reef - 4 Second Reefing	45-41700-195*	101092-9
10.4.5	1	Reefing Line	45-41700-199*	R-5157-95
10.4.6	1	Bridle, Parachute	45-41700-201*	R-5205-301

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

LANDING AND POST-LANDING SYSTEM - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Radioplane No.
10.5	1	Reserve Chute System, Consisting of:	-	-
10.5.1	1	Landing Parachute	45-41700-243*	R-5157-327 or 329
10.5.2	1	Pilot Parachute	45-41700-193*	R-5204-305
10.5.3	1	Bag, Reserve Chute Deployment	45-41700-223*	R-5117-309
10.5.4	1	Lanyard, Pilot Chute	45-41700-149*	R-5136-301
10.5.5	1	Reefing Line	45-41700-199*	R-5157-95
10.5.6	2	Cutter Reef - 4 Second Reefing	45-41700-195*	101092-9
10.6	2	Bag, Landing Parachute Ejector	45-41700-37*	R-5118-301
10.7	2	Disconnect, Landing Parachute	45-41700-191	R-5127-301
10.8	1	Projectile Assembly, Pilot Chute Deploy Gun	45-41700-127*	101070-23
10.9	1	Shear Pin, Pilot Chute Deploy Gun	45-41700-63*	101070-17
10.10	2	Baroswitch, 10,600 Ft. (Mod. By 45-41036)	45-41700-163	101080-15
10.11	1	Switch, Inertia	45-41700-251	58215-307

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

LANDING AND POST-LANDING SYSTEM - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Radioplane No.
10.12	1	Packet Assembly, Fluorescein Dye Marker	45-41700-231*	R-5208
10.13	2	Baroswitch, 21,000 Ft. (Mod. By 45-41036)	45-41700-245	101080-21
10.14	2	Strap Assembly, Adjustable Retaining	45-41700-101	R-5195
10.15	1	Strap Nonadjustable, Insulated	45-41700-117	R-5196
10.16	1	Body Assembly, Gun, Pilot Chute Deploy (Mod. By 45-41034)	45-41700-171	101070-33
10.17	1	Electric Squib, Deployment Gun	45-41700-213*	58082
10.18	1	Squib Cartridge, Electric (Drogue Mortar)	45-41700-211*	58081
10.19	2	Cartridge, Squib, Electric (Parachute Disconnect)	45-41700-209*	58080
10.20	1	Cartridge, Main Charge, Deployment Gun	45-41700-167*	101070-31
10.21	1	Gas Generator Assembly, Main Chute	45-41700-247*	R-5211-1
10.22	1	Gas Generator Assembly, Reserve Chute	45-41700-249*	R-5211-3
10.23	2	Cutter Reefing - 16 Second	45-41700-197*	101092-13

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

LANDING AND POST-LANDING SYSTEM - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Radioplane No.
10.24	1	Bag, SOFAR Bomb	45-41700-227*	R-5207
10.25	1	Packet Assembly, Shark Repellent	45-41700-203*	R-5206
10.26	1	SOFAR Bomb, 4,000 Ft.	45-41700-81*	101010-3
10.27	1	SOFAR Bomb, 3,500 Ft.	45-41700-83*	101010-5
10.28	1	Bridle, Pilot Parachute	45-41700-237*	R-5153-301
10.29	1	Container Assembly, Parachute	45-41010-307	-
10.30	1	Cover, Mortar	45-41014-1	

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

PYROTECHNICS*

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
11		Pyrotechnic Devices, Consisting of:	45-72001-16	-
11.1	**	Squib, Deployment Gun	45-41700-213	-
11.2	**	Squib Cartridge, Drogue Mortar	45-41700-211	-
11.3	**	Gas Generator, Main Chute	45-41700-247	-
11.4	**	Gas Generator, Reserve Chute	45-41700-249	-
11.5	**	Squib Cartridge, Parachute Disconnect	45-41700-209	-
11.6	**	Cartridge, Deployment Gun	45-41700-167	-
11.7	2	Explosive Bolt, Clamp Ring	45-72702-23	Olin Mathieson: 116C-3
11.8	4	Explosive Bolt, Clamp Ring	45-72702-19	Olin Mathieson: 112C-7
11.9	1	Explosive Bolt, Retrograde Rocket Ejector	45-72704-9	Olin Mathieson: 113C-3
11.10	10	Explosive Cell	45-72705-5	Beckman-Whitley: 10084
11.11	5	Ring Assembly	45-72705-7	Beckman-Whitley:

* Pyrotechnic devices to be shipped to launch site for installation.
** Quantities defined under applicable systems.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

PYROTECHNICS* - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
11.12	2	Antenna Fairing Ejector Pyrotechnics Kit, Including:	45-72703-47	-
11.12.1	2	Cartridge	45-72708-301	-
11.12.2	1	Cartridge	-	McCormick Selph: 2561
11.12.3	1	Cartridge	-	Frankford Arsenal: M67E1
11.13	4	Initiator (Chute Deploy, Capsule and Tower Separation)	-	Frankford Arsenal: XM-41
11.14	1	Squib (Whip Antenna)	-	Raymond Eng. Lab. 1529 D-21
11.15	1	Explosive Assembly, Emergency Egress Hatch	45-35701-301	Minneapolis-Honeywell: EX 511838
11.16	1	Bellows Motor - Explosive Actuator	45-83719-3	Propellex: 128-100,000-3
11.17	1	Bellows Motor - Explosive Actuator	45-83719-5	Propellex: 128-100,000-5
11.18	1	Explosive Cell (Snorkel Inlet Door Actuation)	45-72707-5	McCormick Selph: 3625
11.19	**	Valve (Heat Shield Release)	45-61700-482	-

* Pyrotechnic devices to be shipped to launch site for installation.
** See Item 1.2.6.2 for applicable quantity.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

PYROTECHNICS* - (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION M.A.C. No.	IDENTIFICATION Mfg. No.
11.20	2	Cutter, Reefing, 4 Second Time Delay	-	Ordinance Associates: OA-02-4
11.21	**	SOFAR Bomb, 4000 Ft.	45-41700-81	-
11.22	**	SOFAR Bomb, 3500 Ft.	45-41700-83	-

* Pyrotechnic devices to be shipped to launch site for installation.
** Quantities defined under applicable systems.